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TO
HARVARD COLLEGE.
A LEGACY
IN HIS NAME BEING APPLIED
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Robert Troup Paine
to Howard College

THE PHILOSOPHICAL TRANSACTIONS, AND COLLECTIONS,

To the End of the Year 1700.

ABRIDG'D AND Diſpos'd under GENERAL HEADS.

VOL. II.

Containing all the
Phyſiological Papers.

By *JOHN LOWTHORP*, M. A.
and F. R. S.

LONDON:
Printed for *Robert Knaplock*, at the *Biſhop's-Head*, *Richard Wilkin*,
at the *King's-Head*, and *Henry Clements*, at the *Half-Moon* in
St. *Paul's* Church-yard, MDCCXVI.

~~23.4~~

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To His GRACE

The DUKE

OF

ORMOND,

LORD LIEUTENANT

OF

IRELAND, *&c.*

THESE

Phyſiological Papers

ABRIDG'D

AND

Diſpos'd under GENERAL HEADS.

Are with all Poſſible

Humility and Gratitude,

Dedicated by

John Lowthorp.

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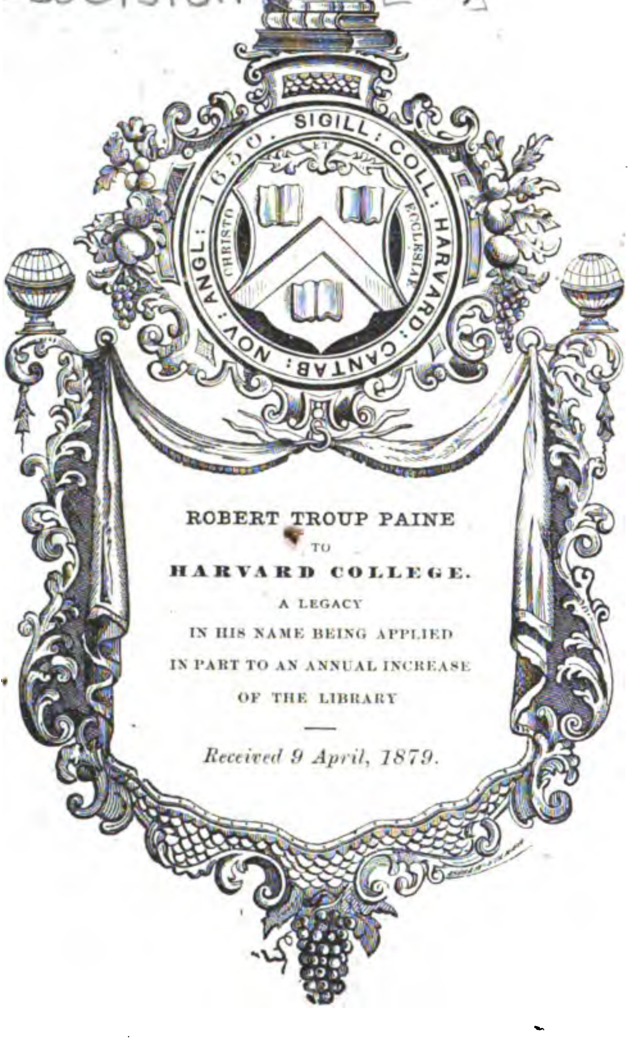
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teſt all the minute Variations in the Preſſure and Weight of Air. With this Inſtrument he made divers Obſervations in the Year 1659, and 1660, before any others were publick, or by him ſo much as heard of.

2. Dr. *J. Beal* is ſo much pleaſed with the Diſcovery already made by the Help of this Inſtrument, that he thinks it to be one of the moſt wonderful that ever was in the World. For (ſaith he) who could ever expect, that we Men ſhould find an Art, to weigh all the Air that hangs over our Heads, in all the Changes of it, and as it were, to weigh, and to diſtinguiſh by Weight, the Winds and the Clouds? Or, who did believe, that by palpable Evidence, we ſhould be able to prove, the ſereneſt Air to be the moſt heavy, and the thickeſt Air, and when darkeſt Clouds hang neareſt to us, ready to diſſolve, or dropping, then to be lighteſt? By Dr. J. Beal. ib. p. 154.

1. My Wheel-Barometer I could never fill ſo exactly with Mercury, as to exclude all *Air*; and therefore I truſt more to a Mercurial Cane, and take all my Notes from it. This Cane is but 35 Inches long, of a very ſlender Cavity, and thick Glaſs. ib. p. 155.

2. In all my Obſervations from *May* 28, 1664, to this preſent (*December* 9, 1665,) the Quick-ſilver never aſcended but very little above 30½ Inches.

3. It aſcended very ſeldom ſo high (viz. to 30½ Inches) chiefly in *December* 13, 1664, the Weather being fickle fair, Evening.

4. I find by my Calender of *June* 22, 1664, at 5 in the Morning, in a Time of long ſettled fair Weather, that the Mercury had aſcended about half an Inch higher than 30: But I fear ſome Miſtake, becauſe I then took no Impreſſion of Wonder at it; yet for 3 or 4 Days, at that Time it continued high in well ſettled fair and warm Weather; moſt part above 30 Inches. So that I may note the Mercury to riſe as high in the hotteſt Summer, as in the coldeſt Winter Weather.

5. Yet ſurely I have noted it to aſcend a little higher for the Coldneſs of the Weather; and very frequently, both in Winter and Summer, to be higher in the cold Mornings and Evenings, than in the warmer Mid-day.

6. Generally in ſettled and fair Weather both of Winter and Summer, the Mercury is higher than a little before, or after, or in rainy Weather.

7. Again, generally it deſcended lower after Rain, than it was before Rain.

8. Generally alſo it falls in great Winds; and ſomewhat it ſeemed to ſink, when I opened a wide Door to it, to let in ſtormy Winds; yet I have found it to continue very high in a long ſtormy Wind, of three or four Days.

9. Again, generally it is higher in an Eaſt and North Wind (*cæteris paribus*) than in a South and Weſt Wind.

10. I tryed ſeveral Times, by ſtrong Fumes, and thick Smoaks, to alter the Air in my Cloſet; but I cannot affirm, that the Mercury yielded any more than might be expected from ſome Increaſe of Heat. Such as have exact Wheel Barometers, may try whether Odors or Fumes do alleviate the Air.

11. I have not in all this Time found the extreameſt Changes of the Quick-ſilver to amount to more, than to 2½, or to 2¾ Inches at moſt.

12. Very often I have found great Changes in the Air, without any perceptible Change in the Barometer; as in the dewy Nights, when the Moiſture deſcends in a great Quantity, and the Thickneſs ſometimes ſeems to hide the Stars from us: In the Days foregoing and following, the Vapours have been drawn up ſo inviſibly, that the Air and Sky ſeemed very clear all Day long. This I account a great Change between aſcending and deſcending Dews and Vapours (which import Levity and Weight) and between thick Air and clear Air; which Changes do ſometimes continue, in the alternative Courſe of Day and Night, for a Week or Fortnight together; and yet the Baroſcope holding the ſame.

13. Sometimes (I ſay not often) the Baroſcope yields not to other very great Changes of the Air. As lately (*Dec.* 18,) an extraordinary bright and clear Day; and the next following quite darkned, ſome Rain and Snow falling, but the Mercury the ſame: So on high Winds and Calms the ſame.

14. I do conceive, that ſuch as do converſe much *ſub dio*, and walk much abroad, may find many Particulars much more exactly than I, who have no Leiſure for it, can undertake. To inſtance in one of many, *Dec.* 16, 1665, was a clear cold Day, very ſharp and ſtrong Eaſt Wind, the Mercury very near 30 Inches high, about 3 in the Afternoon. I ſaw a large Black Cloud drawing near us from the Eaſt and South Eaſt, with the Eaſt Wind: The Mercury changed not that Day, nor the Day following; the Stars and moſt of the Sky were very bright and clear till Nine of the Clock; and then ſuddenly all the Sky was darkned, yet no Change of Weather happened; *Dec.* 17, the Froſt held, and 'twas a clear Day, till about Two of the Clock in the Afternoon; and then many thick Clouds appeared low in the Weſt; yet no Change of the Weather here; the Wind, Froſt, and Quick-ſilver, the ſame, *Dec.* 18. the Mercury fell almoſt ¼ of an Inch; and the Sky and Air ſo clear and bright, and cold with an Eaſt Wind, that I wondred what could cauſe the Mercury to deſcend: I expected it ſhould have aſcended, as uſually it does in ſuch clear Skies. Caſually I ſent my Servant abroad, and he diſcovered the remote Hills, about 20 Miles off, covered with Snow. This ſeemed to manifeſt that the Air, being diſcharged of the Clouds by Snow, became lighter.

15. I have ſeldom ſeen the Change to be very great at any one Time, ſo that I once wondred to ſee, that in one Day it ſubſided about ½ of an Inch.

16. *Jan.* 13, 166$\frac{5}{6}$, the Mercury ſtood (as it did alſo the Day before) a Quarter above 30 Inches; yet both Days very dark and cloudy, ſometimes very Thick and Miſty Air, which ſeldom falls out. For, for the moſt part, I ſee it higher in cleareſt ſettled Weather, than in ſuch cloudy and miſty Fogs. This thick Air and Darkneſs hath laſted above a Week; lately more cold, and Eaſt and North-Eaſt Wind.

a.10.p.163. 17. I have not yet found any ſuch infallible Prognoſtick of theſe Changes of Weather, which do follow a long ſerenity, or ſettled Weather. And perchance in brighter Climates it may be conſtantly infallible. I have ſtore of Hygroſcopes of divers kinds; and I do remark them, and the Sweatings of Marble, and as many other famed Prognoſticks as I can hear of; but can find nothing ſo nearly indicative of the Change of Weather, as this Ballance. And the open Weather-Glaſs is known to ſignifie nothing at certainty, having a double Obedience to two Maſters, ſometimes to the weight of the Air, ſometimes to Heat, as the Service is commanded.

18. In *Jan.* 166¾. for many days it continued very dark, ſo that all Men expected daily great Rain; and though ſometimes thick Miſts aroſe, and ſome ſmall Rain fell, yet the Quickſilver held at a great height; which did indicate to me there could then be no great change of weather, and I was not diſappointed.

19. If the Mercury aſcends to a good height after the fall of Rain (as ſometimes, but leſs often it does) then I look for a Settled Serenity; but if it proceeds after Rain in a deſcending Motion, then I expect a continuance of broken and ſhowry Weather.

20. That we find the Weather and our Bodies more chill, Cold, and Drooping, when the Mercury is loweſt, and the Air lighteſt, beſides other cauſes, I gueſs that as Air is to us the breath of Life, as Water is to Fiſhes; ſo when we are deprived of the uſual Meaſure of this our Food, 'tis the ſame to us as when the Water is drawn Ebb from the Fiſhes.

21. The loweſt deſcent of the Mercury in all the time ſince I have obſerved it, was *Oct.* 26, 1665, in the Evening, when it was very near at 27½ Inches. Which I find thus circumſtanced with the Weather in my Notes.

Oct. 25. Morning; Mercury at 28½ Inches, great Storms and much Rain.

Oct. 26. Morning; Mercury at 28, Winds quiet, thick dark Clouds.

Oct. 26. Evening; Mercury at 27½, That day, and ſome days following, the Weather was variable, frequent Rain, and as you ſee the Mercury lower than uſual.

22. Over the place, where this Mercurial Cane Stands, I have ſet a Wind-vane, with purpoſe of exactneſs, of a Streamer in Braſs ſo large, and pointing to a Board indented in the Margine, that I can at a ſure level upon the Vane, take every of the 32 Points of the wind, Half points and Quarter-points, at a good diſtance. It were good to have an Index of Winds, that diſcovered as well their Aſcent and Deſcent, as their ſide Coaſtings.

23. By Change of Weather and Wind the Mercury ſunk ſince *Mar.* 12, n. 11 p. 185
more than an Inch, and this laſt Night of *Mar.* 18, by Rain and South-
Wind 'tis ſunk half an Inch.

24. I found the Quick-ſilver, *Dec.* 13. 1669. higher than I dare po- n. 55. p.
ſitively affirm that it was ever ſince I had it in my Cuſtody, *viz.* ſince 1113.
May 28. 1664. It was compleatly and apparently above half an Inch more
than 30 Inches high. It continued the 14*th*, and ſome part of the 15*th*, at
about that height; ſometimes manifeſtly higher to an Eighth or Tenth
part of an Inch. For this Baroſcope I have two Glaſs Canes in one Veſſel of

ſtagnant Quick-ſilver; and both of them agreed in this indication. The Weather was at firſt diſcovery very bright and clear, a gentle Froſt, by the Sun's Heat melting. The Air was very ſilent, no Wind ſtirring, and the curious Wind-vane noting, that the wind was directly in the Eaſt all the firſt day, *viz. Dec.* 13. On *Dec.* 14. the wind had a ſhort ſwing from the North-weſt, and haſtened again towards the Eaſt, yet ſo as to be North-eaſt. During this agitation, or change of Winds, the Mercury deſcended a little; and after, upon the reſettling of the wind, the Mercury aſcended a little higher, than it had been the day before.

My Houſe and Study where I keep this Baroſcope, is on the ſide of an Hill; on the higher ſide of this Country, as I gueſs near a Level with the Head of a River; which River running ſlowly, and falling into the *Severn* Sea about 20 or 30 Miles weſtward of *Briſtol*, we cannot be very much above the Level of the Sea. My Thermoſcope, ſtanding cloſe by my ſaid Barometer, was at the juſt height of ordinary diſſolving Weather. In the following Days it was colder. Whether the late Summer drought, or what elſe might incline this Winter-air to have more than ordinary weight, or a ſtronger Spring, I muſt refer to the conſideration of the more Skilful.

By Dr J. Wallis. n. 10. p. 169.

3. In my Baroſcope I never found the Quick-ſilver higher than 30 Inches, nor lower than 28, (at leaſt ſcarce diſcernably, not $\frac{1}{10}$ of an Inch higher than that, or lower than this:) which I mention, not only to ſhew the Limits, within which I have obſerved mine to keep, *viz.* full 2 Inches, but likewiſe as an Eſtimate of the Clearneſs of the Quick-ſilver from Air. For though my Quick-ſilver was with good care cleanſed from the Air, yet I find that which Mr. *Boyle* uſeth, much better: For, comparing his with mine at the ſame times, and both in *Oxford*, at no great diſtance; I find his Quick-ſilver to ſtand always ſomewhat higher than mine (ſometimes near a quarter of an Inch;) which I know not how to give a more probable account of, than that my Quick-ſilver is either heavier than his; or elſe that his is better cleanſed from the Air; (unleſs, poſſibly, the difference of the Bore; or other Circumſtances of the Tube, may cauſe the alteration; mine being a taller Tube, and a bigger Bore than his.) And upon like Reaſon, as his ſtands higher than mine; ſo another, leſs cleanſed from Air, may at the ſame time be conſiderably lower, and conſequently under 28 Inches at the loweſt.

In thick foggy Weather, I find my Quick-ſilver to riſe; which I aſcribe to the heavineſs of the Vapours in the Air.

In Sun-ſhiny Weather, it riſeth alſo (and commonly the clearer, the more;) which I think, may be imputed partly to the Vapours raiſed by the Sun, and making the Air heavier; and partly to the Heat, increaſing the Elaſtick or Springy Power of the Air. Which latter I the rather add, becauſe I have ſometimes obſerv'd in Sun-ſhiny Weather, when there have come Clouds for ſome conſiderable time (ſuppoſe an hour or two) the Quick-ſilver has fallen; and then upon the Sun's breaking out again, it has riſen as before.

In Rainy weather, it uſeth to fall (of which the Reaſon is obvious, becauſe the Air is lightned, by ſo much as falls) in ſnowy weather likewiſe, but not ſo much as in Rain. And ſometimes I have obſerved it, upon a Hoar-froſt, falling in the Night.

For windy Weather, I find it generally to fall; and that more univerſally, and more diſcernably, than upon Rain: (which I attribute to the wind's moving the Air collaterally, and thereby not ſuffering it to preſs ſo much directly downwards; the like of which we ſee in ſwimming, &c.) And I have never found it lower than in high winds.

I have divers times, upon diſcerning my Quick-ſilver to fall without any viſible Cauſe at home, looked abroad; and found (by the appearance of broken Clouds, or otherwiſe) that it had rained not far off, though not with us: Whereupon the Air being then lightned, our heavier Air (where it rained not) may have in part diſcharged it ſelf on that lighter.

Whereas I formerly obſerved, that in Hot Weather, the Quick-ſilver n. 55. p. 1116.
in the Baroſcope did uſe to riſe obſervably, eſpecially in Sunſhine and the Heat of the Day; I now find (having kept the ſame Barometer for the ſpace of 5 Years unaltered) the Caſe, for theſe two Years laſt paſt, to be ſomewhat otherwiſe: And that in hot Sun-ſhiny Weather the Quick-ſilver doth rather ſubſide a little; and in extream Cold and Froſty Weather it riſeth. I judge the cauſe of theſe contrary Obſervations to be this, *viz.* That the Quick-ſilver, at its firſt putting into the Tube or Baroſcope, was not ſo perfectly cleanſed from Air, but that ſome ſmall quantity of it did remain undiſcerned in the Quick-ſilver; Which latent particles of Air, though ſo ſmall as not to be at all diſcernable to the Eye by bubbles, yet by the external heat (adding new ſtrength, as it uſeth to do, to its Elaſtick or Springy Power) were ſo much expanded as to make the Quick-ſilver ſpecifically lighter, and conſequently to riſe ſomewhat higher, and upon the receſs of the External Heat, the Spring of the Air again ſlackning, ſuffered the Quick-ſilver to be again contracted into its former leſſer dimenſions, and ſo to become heavier, and not to riſe ſo high as before, when it was hotter. But now, the Quick-ſilver having continued in the Tube for five Years and upwards, hath by its own weight cleanſed it ſelf better from that little Air that was in it; and that Air, freed from its intanglement with the Quick-ſilver, being got up into the void part of the Tube above the Quick-ſilver, doth act contrary-wiſe; that is, when it is by heat (upon the ſtrengthning of its ſpring) expanded, it preſſeth downward upon the Quick-ſilver, and doth a little depreſs it; and on the contrary, when by Froſt or very Cold Weather this Air (by the abatement of its ſpring) is contracted, the Quick-ſilver, freed from that Preſſure, riſeth a little. But the riſing and ſinking upon this account, (as well that formerly, when this Air was in the Quick-ſilver, as that now, when it is gotten above it,) is not very conſiderable; hardly exceeding the 12*th* part of an Inch.

I ſhall add another Accident which I lately took notice of. I obſerved in the late hard Froſt, that a little drop of Water, (which was at firſt made uſe of for the cleanſing of the Quick-ſilver from the Air, and which hath ever ſince remained on the top of the Quick-ſilver within the Tube; was frozen faſt to the Glaſs. Whereupon I did a little ſhake the Tube by moving it up and down, ſo as to make the Quick-ſilver undulate and ſtrike againſt it. The noiſe upon theſe ſtrokes, was not ſuch a dull noiſe, as Quick-ſilver or other Liquids uſe to make in the open Air, by daſhing againſt Glaſs or Ice, or other ſuch hard Bodies; but ſuch a hard ſmart noiſe, as hard Metals uſe to make by knocking one againſt the other; or, as if this Ice had been ſo knocked by a ſolid piece of Iron or other Metal of ſuch a bigneſs. Which difference of noiſe from what would have been in the open Air (where the intermediate Air muſt firſt have been beat away, before the Quick-ſilver could ſtrike the Ice, and thereby the ſtroke of the liquid Body obtunded or broken,) I attribute to that voidneſs of Air, which was between the Ice and the diſtant Quick-ſilver.

Jan. 7. 16$\frac{69}{70}$, the Baroſcope was at 29, but for ſome Days before about 28^{3}, (the Weather having been windy and rainy;) and ſo it was in the Froſt about *Dec*. 25. but then continued to riſe till about *Jan*. 2. to $29\frac{1}{2}$; but had been *Dec*. 13. at $30\frac{1}{4}$; which is the higheſt I have ever known it in my Baroſcope; $27\frac{1}{2}$ being the loweſt, that I have ever obſerved it in (*Oct*. 26. 1665;) the moſt uſual height being about 29, or ſomewhat higher.

By Mr. Boyle n 11. p 181. 4. It will be very convenient that Obſervers give notice of the ſituation of the place, where their Barometers ſtand, not only, becauſe it will aſſiſt Men to judge, whether the Inſtruments were duly perfected, but principally becauſe, that though the Baroſcope be good (nay becauſe it is ſo) the Obſervations will much diſagree, even when the Atmoſphere is in the ſame ſtate, as to weight, if one of the Inſtruments ſtand in a conſiderably higher part of the Country, than the other.

To confirm the foregoing Admonition, I muſt now inform you, that having in theſe parts two Lodgings, the one at *Oxford*, which you know ſtands in a bottom by the *Thames* ſide, and the other at a place 4 Miles thence, ſeated upon a moderate Hill, I found by comparing two Baroſcopes, that I made, the one at *Oxford*, the other at *Stanton St. Johns*, that, though the former be very good, and hath been noted for ſuch, during ſome Years, and the latter was very carefully fill'd; yet by reaſon, that in the higher place, the incumbent part of the Atmoſphere muſt be lighter, than in the lower, there is almoſt always between two and three eights of an Inch difference betwixt them: And having ſometimes ordered my Servants to take notice of the diſparity, and divers times carefully obſerved it my ſelf, when I paſſed to and fro between *Oxford* and *Stanton*, I generally found, that the *Oxford Barometer* and the other, did, as it were by common conſent, riſe and fall together ſo, as that in the former the Mercury was uſually $\frac{1}{3}$ higher than in the latter. Which Obſervations may teach us, that the ſubterraneous Steams which aſcend into the Air, or the other cauſes of the varying weight of the Atmoſphere, do many times, and at leaſt in ſome places, uniformly enough affect the Air to a greater height, than, till I had made this Tryal, I durſt conclude.

But as moſt of the Barometrical Obſervations are ſubject to Exception, ſo I found the formerly mentioned to be. For (to omit leſſer Variations) riding one Evening from *Oxford* to *Stanton*, and having before I took Horſe look'd on the Baroſcope in the former of theſe two places, I was ſomewhat ſurprized, to find at my coming to the latter, that in places no farther diſtant, and notwithſtanding the ſhortneſs of the time (which was but an Hour and a Half, if ſo much) the Barometer at *Stanton* was ſhort of its uſual diſtance from the other near a quarter of an Inch, though, the Weather being fair and calm, there appeared nothing of manifeſt change in the Air, to which I could aſcribe ſo great a Variation; and tho' alſo ſince that time the Mercury in the two Inſtruments hath, for the moſt part, proceeded to riſe and fall as before.

The Quick-ſilver has been of late for the moſt part ſo high, as to invite me to take notice of it: And about *March* 12, 166$\frac{7}{8}$ at *Oxford* the Quick-ſilver was higher than, for ought I know, has been yet obſerved in *England*, *viz.* about $\frac{1}{10}$ above 30 Inches; but upon the firſt conſiderable Showers that have interruped our long Drought, as I foretold divers Hours before that the Quick-ſilver would be very low, (a bluſtering wind concurring with the Rain) ſo I found it at *Stanton* to fall $\frac{1}{4}$ beneath 29 inches.

It is difficult enough to ſettle any general Rule about the riſing and falling of the Quick-ſilver; yet in theſe parts one of thoſe that ſeem to hold ofteneſt is, that when high Winds blow the Mercury is the lower; and yet that it ſelf does ſometimes fail.

At Cabo Cors *in* Guinea, *by* Mr. Heathcot, n. 18. p 578.

5. At my firſt Arrival I fixt my Weather Glaſs, and found the *Argentum Vivum* to aſcend 29 inches, and in a Tornado 29$\frac{1}{10}$: But a ſtranger by Accident broke the Cane, ſo that I could make no further Tryal.

In Jamaica, *by Sir* Will. Beeſton, n. 220 p. 225.

6. When my Barometer was firſt ſet up, the Mercury ſtood one Degree below Changeable; I diligently obſerved it every Day, and found that in the Mornings before the Sun aroſe it would be there; and as the Heat encreaſed with the Day, it ſunk to within one Degree above Rain; there it continued ſeveral Days, and never altered above 3 Degrees, tho' ſometimes fair, ſometimes Rain, and ſometimes cloudy; and one Morning leaving open my Window, and the Sun having South Declination, it ſhone in on the viſible part of the Tube, and in half an Hour it ſunk 3 Degrees; (which I never obſerv'd it to do with heat in *England*) I preſently ſhut the Window, and in one Hour it aroſe again to within one Degree of Changeable; after it had kept this Courſe in ſeveral Weathers, for 6 Weeks together, I began to doubt if it were well adjuſted, and therefore took it down, new filled the Tube, turned it 3 or 4 times up and down, to let out the Air, and put it up with great Care, and ever ſince it continues the ſame, never by one degree to Changeable, nor down by one degree to Rain; ſo that the whole Progreſs of the Mercury is but $\frac{1}{10}$ of an inch.

The loweſt degree of the Barometer; by Bp. of Cloyne, n. 243. p 293.

7. *March* 3. 168$\frac{6}{7}$ in the Evening, we had very much Thunder, and that and the next Day the Mercury in the Barometer was much lower than ever I obſerved it, *viz.* but $\frac{4}{10}$ above 28 inches.

The Agreement of the Barometers at London *and* Towneley; *by Mr.* Towneley, n. 208. p. 56.

8. I have found by a whole Month's Obſervations, Mr. *Flamſteed* was pleaſed to ſend me, the Mercury ſtill roſe and fell both at *London*, and here exactly at the ſame time; I always found it rather more than $\frac{1}{10}$ of an

inch lower here than there, by reaſon that we are ſeated though in a ſeeming Valley, in reſpect of the Neighbouring Grounds, yet we are conſiderably higher than the other low Lands near the Sea, where the Standard differs little from that at *London*. In confirmation of what I have ſaid, I ſuppoſe you may not be diſpleaſed with two remarkable Obſervations, made both by Mr. *Flamſteed* and me at the ſame time; *viz. Nov.* 18. 1674. when finding the Mercury to deſcend both very faſt and very low, we watched it very nicely, and both of us obſerved, that at 2 in the Afternoon it was rather falling, and rather riſing at 4; at which times the height was only here 27, 63 inches, and at *London* $\frac{1}{10}$ higher.

A Portable Barometer, by Mr. Will. Derham, n. 236. p. 3.

V. Provide a ſtrong Glaſs Tube. Let the Head of it be pinched at about an inch from the Top, ſo as to make a Narrow Neck, whoſe Orifice ſhall be as big almoſt as a Straw. This (which is Mr. *Quare*'s way) will much bridle the blow of the Mercury againſt the Top, as it danceth up and down, which endangers breaking off the Top of the Tube. The Bottom of the Tube I would have ground aſlant near half on inch, that the bottom of the Tube touching the bottom of the Ciſtern, the Orifice thereof may lie about the middle of the Mercury in the Ciſtern; which will prevent the Air getting into the Tube, by reaſon the Mercury is always about the Mouth of the Tube. The Ciſtern muſt be made wide, either of Glaſs, or cloſe grained Wood; round the Brim of which, on the out-ſide, muſt be a Notch to tye on the Leather that is to cover it. When the Tube is filled, cleared of Air, and plunged into the Ciſtern near full of Mercury, encloſe the Mercury with gentle Leather tied very faſt round the Tube near the bottom, which being ſpread over the Ciſtern, tye it round that alſo: The Tube and Ciſtern, thus conjoined with Leather, muſt be lodged in a Caſe, made very fit to receive both, where they muſt lie very faſt. Through the Caſe let 3 or 4 Holes be bored, to let the Air in freely to the Leather that covers the Ciſtern, which lying cloſe againſt the Holes, will firmly enough keep the Mercury from running out at them.

To enlarge the Diviſions of the Barometer; by Dr. Hook, n. 185. p. 241.

VI. 1. To make the more minute Variations in the Air's Preſſure ſenſible, Dr. *Hook* invented the Wheel Barometer. But this did not anſwer fully the deſigned exactneſs, both for that the Mercury being apt to ſtick againſt the ſides of the Glaſs, would riſe and fall *per ſaltum* all at once, and becauſe it is very difficult to adjuſt the *apparatus* of this Inſtrument, as alſo that it is exceeding apt to be out of order, for which reaſons it is at preſent almoſt wholly laid aſide.

Upon this in *June* 1668. (as appears on the Journal of the *Royal Society*) he bethought himſelf of another Device to do the ſame thing, which was to encreaſe the diviſions, by putting coloured Spirit of Wine, or ſome other Liquors not capable of freezing, on the Mercury, which Liquor was made to riſe as the Mercury fell, and fall as it roſe, in a narrow Cane, ſo as to make the utmoſt Limits about two foot aſunder. But yet he was not ſatisfied, till he had found out the means of encreaſing the Diviſions of the Barometer *ad libitum*, which he produced before the *Royal Society* at their meeting on *Feb.* 3, 1685. *ſt. vet.* The contrivance whereof is this:

The Cylinder *A*, may be of what Diameter you pleaſe, the bigger the better, but it need not be above 2 inches long, the Cane *A D*, muſt be ſo long that the upper part of the Cylinder *B* may be 29 inches + ſuch a part of the height of the other Cane *BC*, as the weight or ſpecifick Gravity of the Liquor that is to fill that Cane is to the ſpecifick Gravity of Mercury, below the line *A B*, in the Cylinder *A*. The third Cylinder *C*, may be as high as you pleaſe above the Cylinder *B*, but is moſt conveniently made, ſo as the ſquare of the Diameter of the Cane *B C*, be to the ſquare of the Diameter of the Cylinders *B* or *C*, (which muſt be exactly equal) as the riſe of the Mercury in the Cylinder *B*, is to the whole length of the Cane *B C*: For in this caſe there will be nothing ſuperfluous, but the diviſions enlarged to the utmoſt advantage. Fig. 1.

As to the method of filling this Baroſcope, tho the Inventor hath not as yet declared his own contrivance for the doing it, yet it will not be unneceſſary to ſhew here how it may be done. One way (and the beſt that occurs at preſent) is to leave a ſmall hole at the top of the Cylinder *A*, and another near the top of the Cylinder *B*, this latter being well ſtopt, pour in as much Mercury at the other hole in *A*, as ſhall fill both Canes as high as the level of the ſaid hole; which done, ſtop either by hermetically ſealing it, or elſe by a drop of Seal-wax (the Glaſs being firſt ground rough to make it ſtick) in the hole *A*; then opening the hole in *B*, draw off as much of the Mercury of the Cane *B C* till it will run no longer: Which done, ſtop firmly the hole in *B* (which may be done as you pleaſe, there being no Preſſure againſt you) and you will have the Cylinder *A*, evacuated of Air for your purpoſe; and the height of the Mercury will be as is uſual in the ordinary plain and Wheel Barometers. Then pour into the Cane *B C* as much Spirit of Wine tinged with Cochinele, and Oil of Turpentine, equal parts of each, as ſhall ſtand above the ſurface of the Mercury ſo many feet as you make the enlarged ſcale of your Barometer, or as is between the middle of the Cylinders *B* and *C*, and you will find the Mercury ſink in the Cane *B C*, and riſe in the other Cane *A D*, in ſuch proportion, that each 13 foot of Oil and Spirit, will raiſe the Mercury 10 inches: This done, you muſt pour on, by the Cane *B C*, ſo much Mercury as may fill up the Cylinders *A* and *B*, to ſuch heights, conſidering the preſent weight of the Atmoſphere, that the ſurface of the Mercury in both, may at the utmoſt Limits, (which have not in *England* been found to exceed 30, 6 and 28, 6 inches) always fall within the bodies of the Cylinders, and never enter into the Canes.

Here note, That theſe Liquors are choſen upon two accounts; Firſt, they are exceeding near of a weight, and Spirit of Wine highly rectified is ſomewhat lighter than Oil of Turpentine, but by a very ſmall Addition of Phlegm or Water, the Spirit will preponderate and be undermoſt; ſo that you may make them as near of a weight as you pleaſe, and conſequently a Cylinder of the Oil inſenſibly differing from an equal Cylinder of Spirit of Wine. Secondly, they are Liquors that will not mix; ſo that the Oil of Turpentine ſwimming on the top, will be divided by a line only from the tinged Spirit of Wine, which the Oil will keep from evaporating.

The Effect of this Baroſcope will be, that when the Atmoſphere is heavy, and the Mercury raiſed high in the Cylinder *A*, and retired out of *B*, the Spirit of Wine will deſcend into the Cylinder *B*, and the Oil of Turpentine will fill the Cane, ſo as to make the partition of the two Liquors near the Cylinder *B*. But on the contrary, when the Air is light, the Mercury will ſink in *A*, and riſe in *B*, ſo as to drive the Spirit of Wine into the Cane, and the Oil of Turpentine into the Cylinder *C*, ſo that the Section of the two Liquors will be near *C*, and the Variation of the height of the Mercury will be enlarged into almoſt the length of the Cane, without that the Counter preſſure from the Liquors will be in the leaſt altered, the height and weight of the incumbent Cylinders being always the ſame.

That little alteration that may happen by the dilatation and contraction of the Spirit of Wine by heat and cold, which ought to be accounted for, may be beſt diſcovered by a Thermometer hanging by it, (containing the ſame quantity of the Spirit of Wine, and whoſe Cane is, as near as may be, of the ſame Diameter with the Cane *B C*, in the Barometer) whoſe Deſcent and Aſcent muſt be added and ſubſtracted to reduce it to a rigorous exactneſs; but it is ſtill worth while to enquire if the Mercury it ſelf do not ſhrink and ſwell with cold and heat, ſo as not to need this correction.

By —— n. 236. p. 4. *Fig.* 2. 2. *A*. The head of the Tube, with its narrow Neck, to bridle the Blow of the Mercury, as formerly directed for a portable Barometer.

B. The bottom ground aſlant.

C. The Crook.

D D. The Weather Plates.

By bending the Tube more or leſs at *C*, an inch of perpendicular height may be made 2 or 3 inches.

By Mr. Derham, n. 237. p. 45. *Fig.* 3. 3. *AA*. A Ruler with teeth on one edge of it, made to ſlided up and down.

b. A little Finger, fixt to the Ruler, which muſt be raiſed or depreſſed till it point exactly to the height of the Mercury.

CCCC. The Index Wheel containing juſt as many Teeth as there are Teeth in an inch of the ſliding Ruler; ſo that by thruſting up and down this toothed Ruler, you may at every inch turn round the Index once.

DDDD. A Circle, divided into 100 parts anſwering to 100 parts of an inch on the ſliding Ruler.

ee. The Index, which being faſtned to the Arber of the Index Wheel, is driven round with it, and ſhows on the Circle, the parts of an inch which the Mercury riſeth or falleth in the Tube.

By Mr. Steph. Gray, n. 240. p. 176. *Fig.* 4. 4. *A* A long ſquare Table. Towards one end is erected a ſquare Column, *BB*. Upon which there ſlides a ſquare Socket *C*. From one ſide whereof proceeds a crooked Arm, *DE*. At *D* there is a Screw-hole to receive the Screw, and at *E* a Ring to ſupport the Tube of the Microſcope *F*. From the other ſide the Socket comes a ſhort Arm *G*, having a Screw-hole to receive the long Screw *II*, whoſe length may be about 6 or 7 inches: Its lower end, by a ſmall hole in its Center, reſts on the end of a ſmall Screw, that comes through the Screw-hole, in the Arm *H*, which is fixed on the backſide of the Column; the upper end of the Screw is filed leſs than the Body of the Screw, and goes through the Center of the round Plate without ſhaking; and to prevent its doing ſo, either upwards or downwards, there is added a ſpringing Plate *n*; which keeps the Shoulder of the Screw cloſe to the underſide of the Plate *K*; over this Plate there goes an Index *o*, and over that an Handle *L*, upon the end of the Screw which comes thro' the Center of the Plate, which I ſhould before have told you, is riveted to the top of the Column *BB*. The Teeth of the Screw muſt be of that Size, as to have juſt 10 in an Inch. The foreſide of the Column muſt be divided into Inches and Tenths, beginning about the Height of the Socket *H*, where the lower end of the Screw reſts, and ſo continue to the Top of the Column. The Limb of the round Plate muſt be divided into an 100 Parts. In the Focus of the Eye-glaſs of the Microſcope is fixed an Hair, or very fine ſilver Wire, in a Horizontal Poſition.

When you uſe this Inſtrument, take hold of the Handle, and looking through the Microſcope, turn the Screw till you have brought the Hair to touch, as it were, the Surface of the Mercury *m*; then obſerve what Diviſions are cut on the Column, by the upper or under edge of the Socket, which are *tenths* of an Inch. See likewiſe to what Parts the Index points on the Limb of the round Plate, which are Hundreds of a Tenth, or Thouſand Parts of an Inch; when you perceive the Mercury varied, raiſe or depreſs the Microſcope, till the Hair be brought to its Surface, as before; then by ſubſtracting the leſſer from the greater of the two obſerved Numbers, you will have the Variation in Inches and thouſand Parts.

This Inſtrument becomes a Micrometer on the ſame Principles, though I was obliged to alter its Structure from that uſed with the Teleſcope, which was firſt invented by Mr. *Gaſcoign*, improved by Mr. *Townley*, and deſcribed by Dr. *Hook*.

Vid. Vol. I. Chap. IV. S. V. 1, 2.

The Thermometer is alſo capable of the like Improvement.

VII. 1. *May* 26, 1697, between one and two in the Afternoon, on the top of *Snowdon* Hill I thrice repeated the *Torricellian* Experiment, and as often found the Height of the Mercury 26,1 Inches. And being come down to *Llanberris*, at the Foot of the Hill, about 6 that Evening, I as often found it 29,4 inches. The next Day about 8 in the Evening I found the Mercury by a triple Experiment, to ſtand at 29,9 inches, very near the Surface of the Sea; when at the ſame time, at *Llanerch* in *Denbyſhire* (about 25 Miles Eaſt from *Snowdon*, and 6 from the Sea, ſeveral Foot above the Surface of it) by Mr. *Davis*'s ſtanding Barometer it was above 29, 7½. And the Air continued both before and after in the ſame State. Hence I conclude, that the Difference of the Air's Preſſure on the Sea, and on the Top of *Snowdon*, is rather more than 3 Inches 8 Tenths. I could have wiſhed for one of Mr. *Hunt*'s portable Barometers; which will certainly be accurate enough for taking the Levels for bringing of Water from diſtant Places, and certainly much leſs ſubject to Error; there being a Tenth of an Inch for each 30 Yards, which may be divided into many Parts evidently. *Snowdon* was meaſured by Mr. *Caſwell*, with *Adam*'s Inſtruments, to be 1240 Yards high; which abating the Height of the Mercury 3 Inches 8 Tenths, may ſerve for a Standard, till a better be obtained on a higher Place.

The Height of the Mercury, *at the top of* Snowdon *Hill; by* Mr. Halley, n. 229. p. 582.

Conſidered; by Dr. Wallis, n. 233. p. 653.

2. This Obſervation had been more uſeful, had it been repeated at ſeveral other perpendicular Heights in the Aſcent. For from ſuch comparative Obſervations, we may make a Judgment of the Height of the Atmoſphere.

At the top of the Monument; by Mr Derham. n. 236. p. 2.

VIII. In *Sept.* 1696, I obſerved the Variation of the Mercury on the *Monument*, and found by one of Mr. *Quare*'s beſt portable Barometers, that it deſcended $\frac{1}{10}$ of an Inch at the Height of 80 Feet, and $\frac{2}{10}$ at 160 Feet.

But ſince that, finding my Obſervations a little different from Mr. *Halley*'s on *Snowdon* Hill, I tryed it again more nicely, in *Nov.* 1697, after this Manner; I provided a pretty large glaſs Tube well cleaned: This I lodged in wire, and fill'd it with well ſtrain'd Mercury; which being clear'd of all Air, I then plung'd the bottom of the Tube into a broad Ciſtern of Mercury, and then fixed both the Tube and Ciſtern together, in a wire Caſe or Frame. On the top I left an Eye in the Wire, to ſuſpend the whole Barometer on a String, that it might hang pendulouſly, which is abſolutely neceſſary, becauſe if the Ciſtern be deeper on one ſide than another, or if the Tube hang more towards one ſide than the other, it will cauſe a great and erroneous Variation in the Mercury above, according as the Tube ſtands perpendicularly, or not.

My Inſtrument being thus (I think) very nicely prepared, I marked exactly the height of the Quick-ſilver, upon 2 narrow Labels of Paper, paſted on each ſide the Tube, both at the Bottom, and in my Aſcent up the Monument. The Differences of the Mercury's Height I meaſured with a Decimal Inch Scale of thin Braſs. The Quantity of my Aſcent I meaſured with a *Gunter*'s Chain, becauſe a String would ſtretch. By the niceſt Obſervation I could make, I found that at the Height of 82 Feet, the Mercury fell, $\frac{1}{10}$ of an Inch, and at about 164 Feet $\frac{2}{10}$.

By tarrying above ſomewhat long, I perceived the Preſſure of the Atmoſphere was ſomewhat altered, ſo that the Mercury in my Deſcent was about 0,01 of an Inch different from my Obſervations in aſcending. Upon which, I repeated my Experiment, by aſcending and deſcending quicker. At both which Times, my Obſervations agreed exactly with the firſt Tryal. From whence I conclude, that at every 82 Feet Height, or thereabouts, the Mercury will deſcend $\frac{1}{10}$ of an Inch. But I am inclined to think, that the Mercury riſeth or falleth ſometimes more, ſometimes leſs at one and the ſame Height. As for inſtance, if the Mercury ſinketh 0,1 of an Inch, at the Height of 82 Feet, when the Mercury ſtandeth at 30 Inches in the Barometer, I *query*, whether it will ſink ſo much when the Barometer is at 29 inches.

n. 237, p 46.

The heights of the mercurial Cylinder at any Elevation above the Surface of the Earth; by Mr. Halley, n. 181. p. 104.

IX. It has been ſhown by undoubted Experiments, that the ſpecifick Gravity of the Air, near the Earth's Surface, to that of Water, was once as 1 to 840, again as 1 to 852, and a 3*d* Time, in a very large Veſſel holding ten Gallons, as 1 to 860; all which, conſidering the Difficulty of the Experiment, agree well enough, the Mercury ſtanding at all thoſe Times about 29 inches $\frac{3}{4}$; but by Reaſon 'twas Summer Weather, and conſequently the Air rarified, when all theſe were tryed, we may without ſenſible Error ſay in round Numbers, that the Barometer ſtanding at 30 inches, and in a mean State of Heat and Cold, the ſpecifick Gravity of the Air to Water, is as 1 to 800. By the like Tryals the Weight of the Mercury to

Water, is as 13½ to 1, or very near it, ſo that the Weight of Mercury to Air is as 10800 to 1, and a Cylinder of Air of 10800 inches, or 900 Feet, is equal to an Inch of Mercury, and were the Air of an equal Denſity like Water, the whole Atmoſphere would be no more than 5,1 Miles high, and in the Aſcent of every 900 Feet the Barometer would ſink an Inch. But the Expanſion of the Air encreaſing in the ſame Proportion as the incumbent Weight of the Atmoſphere decreaſes, that is, as the Mercury in the Barometer ſinks, the upper Parts of the Air are much more rarified than the lower, and each Space anſwering to an Inch of Quick ſilver, grows greater and greater, ſo that the Atmoſphere muſt be extended to a much greater Height.

Theſe Expanſions of the Air being reciprocally as the Heights of the Mercury, it is evident, that by the Help of the Curve of the *Hyperbola* and its *Aſymptotes*, the ſaid Expanſions may be expounded to any given Height of Mercury; for by the 65*th Prop. Lib.* 2. *Conic. Mydorgii*, the Rectangles *ABCE*, *AKGE*, *ALDE*, *&c.* are always equal, and conſequently the Sides *CB*, *KG*, *LD*, *&c.* are reciprocally as the Sides *AB*, *AK*, *AL*, *&c.* If then the Lines *AB* *AK*, *AL*, be ſuppoſed equal to the Heights of the Mercury, or the Preſſures of the Atmoſphere, the Lines *CB*, *KG*, *LD*, anſwering thereto, will be as the Expanſion of the Air under thoſe Preſſures, or the Bulks that the ſame Quantity of Air will occupy; which Expanſions being taken infinitely many, and infinitely little, (according to the *Method* of *Indiviſibles*) their Sum will give the Spaces of Air between the ſeveral Heights of the Barometer; that is to ſay, the Sum of all the Lines between *CB*, and *KG*, or the Area *CB*, *KG*, will be proportioned to the Diſtance or Space intercepted between the Levels of two Places in the Air, where the Mercury would ſtand at the Heights repreſented by the Lines *AB*, *AK*; ſo then the Spaces of the Air anſwering to equal Parts of Mercury in the Barometer, are as the Areas *CBKG*, *GKLD*, *DLMF*, *&c.* Theſe Areas again are, by the Demonſtration of *Gregory of St. Vincent*, proportionate to the Logarithms of the Numbers expreſſing the *Rationes* of *AK* to *AB*, of *AL* to *AK*, of *AM* to *AL*, *&c.* So then by the common Table of Logarithms, the Height of any Place in the Atmoſphere, having any aſſigned Height of the Mercury, may moſt eaſily be found: For the Line *CB* in the *Hyperbola*, whereof the Areas deſign the Tabular Logarithms, being 0,0144765; 'twill be as 0,0144765, to the Difference of the Logarithms of 30, and any other leſſer Number, ſo 900 Feet, or the Space anſwering to an Inch of Mercury, if the Air were equally preſt with 30 Inches of Mercury, and every where alike to the Height of the Barometer in the Air, where it will ſtand at that leſſer Number of Inches: And by the Converſe of this Proportion may the Height of the Mercury be found, having the Altitude of the Place given. From theſe Rules I derived the following Tables. Fig. 5.

Given

Given Heights of the Mercury.	*Altitudes.*	
Inches	Miles	Feet
30		0
29		915
28		1862
27		2844
26		3863
25		4922
20		10947
15		18715
10		29662
5		48378
1		91831
0,5		110547
0,25		129262
0,1	29 *or*	154000
0,01	41 *or*	216169
0,001	53 *or*	278338

Given Altitudes.	*Heights of the Mercury,*
Feet	Inches.
0	30, 00.
1000	28, 91.
2000	27, 86.
3000	26, 85.
4000	25, 87.
5000	24, 93.
Miles 1	24, 67.
2	20, 29.
3	16, 68.
4	13, 72.
5	11, 28.
10	4, 24.
15	1, 60.
20	0, 95.
25	0, 23.
30	0, 08.
40	0, 012.

Upon theſe Suppoſitions it appears, that at the Height of 41 Miles, the Air is ſo rarified as to take up 3000 Times the Space it occupies here, and at 53 Miles high it would be expanded above 30000 Times; but 'tis probable, that the utmoſt Power of its Spring cannot exert it ſelf to ſo great an Extenſion, and that no Part of the Atmoſphere reaches above 45 Miles from the Surface of the Earth.

This ſeems confirmed from the Obſervations of the *Crepuſculum*, which is obſerved commonly to begin and end when the Sun is about 18 *Deg.* below the *Horizon*; for ſuppoſing the Air to reflect light from its moſt rarified Parts, and that as long as the Sun illuminates any of its Atoms, they are viſible to an Eye not intercepted by the Curvity of the Earth, it will follow that the Proportion of the Height of the whole Air, to the Semidiameter of the Earth, is much about as 1 to 90, or as the Exceſs of the Se-
Fig. 6. cant of about 8½ *Deg.* to Radius. For if *E* be the Eye of the Obſerver, *S* a Place where the Sun ſets at the End of Twilight in *E*, and the Arch *E C S*, or *T C A*, be found 18 *Deg.* the Exceſs of the Secant of half thereof *E C H*, would be the Height of the Air, *viz.* *G H*: But the Beam of the Sun *A S H*, and the viſual Ray *E H*, do each of them ſuffer a Refraction of about 32 or 33 *Min.* whereby being bent inwards from *H*, towards *G*, the Height of the Air need not be ſo great as if they

they went ſtreight; and having from the Angle *ECS*, taken the double Refraction of the *Horizontal* Ray, the half of the Remainder will be 8½ *Deg. circiter*, whoſe Secant being 10111, it follows that as 10000 to 111, ſo the Semidiameter of the Earth ſuppoſed 4000 Miles, to 44,4 Miles; which will be the Height of the whole Air, if the Places *E*, *S*, whoſe viſible Portions of the Atmoſphere *ERZH*, and *SHKB*, juſt touch one the other, be 18 *Deg.* aſunder.

At this Height the Air is expanded into above 3000 Times the Space it occupies here, and we have ſeen the Experience of condenſing it into the 60 Part of the ſame Space, ſo that it ſhould ſeem, that the Air is a Subſtance capable of being compreſſed into the 180000 part of the Space it would naturally take up, when free from Preſſure: Now what Texture or Compoſition of Parts ſhall be capable of this great Expanſion and Contraction, ſeems a very hard Queſtion; and which, I ſuppoſe, is ſcarce ſufficiently accounted for, by the comparing it to Wool, Cotton, and the like ſpringy Bodies.

'Tis true, the Weight of the whole Atmoſphere is various, being counterpoiſed ſometimes by 28½ Inches of Mercury, and at other Times by no leſs than 30½, ſo that the under Parts being preſſed by about a 15*th* Part, leſs Weight, the ſpecifick Gravity of the Air upon that Score, will ſometimes be a 15*th* Part lighter than another; beſides, Heat and Cold does very conſiderably dilate and contract the Air, and conſequently alter its Gravity, to which add the Mixture of Effluvia or Steams riſing from almoſt all Bodies, which aſſimulating into the Form of Air, are kept ſuſpended therein, as Salts diſſolved in Liquors, or Metals in corroding Menſtrua, which Bodies being all of them very much heavier than Air, their Particles by their Admixture muſt needs encreaſe the Weight of that Air they lie incorporated withal, after the ſame Manner as melted Salts do augment the ſpecifick Gravity of Water. 'Tis alſo true, that the Condenſations are not poſſible beyond certain Degrees, for being compreſſed in an 800*th* Part of the Space it takes up here, its Conſiſtence will be equally denſe with that of Water, which yields not to any Force whatſoever, as hath been found by ſeveral Experiments tried here, and at *Florence* by the *Academia del Cimento*. Nor can the Rarefaction proceed *in infinitum*; for ſuppoſing the Spring whereby it dilates it ſelf, occaſioned by what Texture of Parts you pleaſe, yet muſt there be a determinate Magnitude of the natural State of each Particle, as we ſee it is in Wool, and the like, whoſe Bodies being compreſſible into a very ſmall Space, have yet a determinate Bulk which they cannot exceed, when freed from all Manner of Preſſure.

Theſe Objections diſturb the Geometrical Accuracy of theſe Concluſions drawn from the ſpecifick Gravity of the Air, obſerved at any Time; but the Method here ſhewn will compute, by a like Calculation, the Heights of the Quilk-ſilver, and the Rarefactions of the Air from any aſſigned Height of the Barometer at the Earth's Surface, and any ſpecifick Gravity given. As to the Condenſation and Rarefaction by Heat and Cold, and the various Mixture of aqueous and other Vapours, theſe two Objections ſeem generally to compenſate each other; for when the Air is rarified by Heat, the Vapours are raiſed moſt copiouſly, ſo that tho' the Air properly ſo call'd, be expanded, and conſequently lighter, yet the Interſtices thereof being crouded full of Vapours of much heavier Matters, Bulk for Bulk, the Weight of the Compoſitum may continue much the ſame; at leaſt a moſt curious Experiment made by the ingenious Mr. *John Caſwel* of *Oxford*, upon the Top of *Snowdon Hill* in *Caernarvanſhire*, ſeems to prove that the firſt Inches of Mercury have their Portions of Air near enough to what I now determine; for the Height of the Hill being 1240 Yards, or very near it, he found the Mercury to have ſubſided to 25,6 Inches, or 4 Inches below the mean Altitude thereof at the Level of the Sea, and the Space anſwering to 4 Inches, by my Calculation ſhould be 1288 Yards; and it agrees as well with the Obſervation in the Appendix to M. *Paſcal*'s Book, *del' Equilibre des Liquers*, made on the high Hill in *Auvergne*, call'd *Le Puy de Domme*. So that the Rarefaction and Vapours ſeem not to have alter'd conſiderably the Gravity of the under Parts of the Air; and much above the Height where theſe Experiments were made, do few Vapours aſcend, and the Cold is ſuch, that the Snow lies continually, ſo that for the more elevated Parts of the Sphere of Air there is much leſs Reaſon to doubt.

The Reaſon of the Aſcent of the Quick-ſilver; by Dr. Liſter. r. 165. p. 970.

X. 1. It is obſerved of the Barometer, that the Quick-ſilver is not affected with the Weather, or very rarely, let that be either cloudy, rainy, windy, or ſerene in St. *Helena*, or the *Barbadoes*: and therefore probably not within the *Tropicks*, unleſs in a violent Storm or Hurricane. The firſt is affirmed by Mr. *Halley*, who kept a Glaſs near two Months in the Iſland St. *Helena*, and the other of *Barbadoes* ſtands upon the Credit of our Regiſters.

2. In *England* in a violent Storm, or when the Quick-ſilver is at the very loweſt, it then viſibly breaks and emits ſmall Particles, as I have more than once obſerved; which Diſorder I look upon as a Kind of Fretting; and conſequently at all Times of its Deſcent, it is more or leſs upon the Fret.

In this Diſorder of the Quick-ſilver, I imagine it hath its Parts contracted and cloſer put together; which ſeems probable, for that, for Example, the Quick-ſilver then emits, and ſqueezes out freſh Particles of Air into the Tube, which encreaſing the Bulk of the Air, and conſequently its Elaſticity, the Quick-ſilver is neceſſarily depreſs'd thereby, that is, by an external Force or Power; and alſo, the Quick-ſilver muſt of it ſelf come cloſer together in its own internal Parts, that is, deſcends for both Reaſons.

And that much Air is mixed with it, appears from the Application of a heated Iron to the Tube, as is practiſed in the purging of it that Way; and alſo for that poliſh'd Iron will ruſt, though immers'd in it, as ſome Philoſophers have lately obſerved.

Now when the Quick-ſilver riſes in the Pipe (which it certainly does both in hot and froſty Weather) it may then be ſaid to be in a natural State, free, open, and expanded like it ſelf, which it ſeems it ever is within the *Tropicks*, and with us only in very hot, and very froſty Weather. But when it deſcends, it is then contracted, and as it were convulſed and drawn together, as it moſtly is in our Climate of *England*, and more or leſs, as we gueſs, in all Places on this Side the *Tropicks*. Which Contraction plainly appears from the concave Figure of both Superficies, not only in that of the Quick-ſilver in the Tube, but alſo (it well obſerved) in that which ſtagnates in the Pot or Diſh it ſelf.

The Difficulty ſeems to lie in the reconciling the ſame Effect of the Quick ſilver's riſing in the Tube, from ſuch ſeemingly different Cauſes, as great Heat and intenſe Froſt: and thoſe who ſhall willingly aſſent to us in one Particular, and grant us Warmth as a probable Cauſe of its Reſtitution to its Nature, will yet be at a Stand how to imagine, that great Froſt likewiſe ſhould bring the Quick-ſilver nearer its own Nature too: I anſwer, that Salts liquified will coagulate or cryſtallize, that is, will return to their own proper Natures, both in Cold and in Heat; and therefore, tho' moſt Men practiſe the ſetting them in a cool Cellar for that Purpoſe, yet ſome (as *Zwelfer*) adviſe, as the beſt Means to have them ſpeedily and fairly cryſtallized, to keep them conſtantly *in Balneo.* Thus alſo the Lympha of the Blood does become a Jelly, if you ſet it in a cool Place, and the ſame is by Warmth in like Manner inſpiſſated. Again, that it is no new Opinion, that Water is naturally Ice, if no Diſquiet from ſome external Accident hinder. *Bornichius* the learned *Dane* has ſaid ſomething for it: And altho' ſome may think that what he hath ſaid, was a meer Complement to his own frozen Climate, yet I dare venture to add, in Confirmation of that Doctrine, that Salt is naturally Rock, that is naturally foſſile, not liquid; and yet this is moſt like Ice of any thing in Nature, not only becauſe of its Tranſparency, but alſo for its eaſy Liquefaction, and the ſudden Impreſſions and Changes which Air makes upon it, ſo that it is ſcarce to be preſerved in its natural State of Cryſtallization. Alſo Salts of all Sorts ſeem naturally to propagate themſelves in a hard State, and to vegitate in a dry Form. The like is to be obſerved in Quick-ſilver, of its being a hard Rock, and alſo from its Willingneſs to embrace upon all Occaſions a more fixt State, as in its Amalgamizing with almoſt all Sorts of Metals.

It will not be amiſs by way of Corollary, to add a Note or two about healthful and ſickly Seaſons, more particularly as they may refer to this *Phænomenon* of great Cold and Froſt. If therefore Quick-ſilver and Liquids are neareſt their own Natures, and have leſs Violence done to them, in very cold and very hot Seaſons, the Humours of our Bodies, as Liquids, in all Probability muſt be in ſome Meaſure accordingly affected. And that therefore Cold is healthful, I argue from the vaſt Number of old Men and Women, to be found upon the Mountains of *England*, comparatively to what are found elſewhere.

Again, the Blood it ſelf, or the vital Liquor of Animals equivalent to it, is in moſt kinds of Animals in nature ſenſibly cold; for that the Species of Quadrupeds and Fowls are not to be compared for Number to Fiſhes and Inſects; There being in all Probability, by what I have obſerved, above a hundred Species of theſe latter Creatures, whoſe vital Juice is cold, to one of the former: But becauſe we moſt converſe with thoſe whoſe vital Juice is hot, we are apt to think the ſame of all.

Again, I have obſerved, which I offer as an Argument of the little injury intenſe Cold does to the Nature of Animals. I ſay, I have ſeen both Hexapode Worms (which I compare to the tender Embrio's of ſanguineous Animals, becauſe ſuch are in a middle State) and Flies of divers Sorts hard frozen in the Winter, and I have taken them up from the Snow, and if I caſt them againſt the Glaſs, they would endanger the breaking of it, and make it ring like ſo much hard Ice; yet when I put the Inſects under the Glaſs, and ſet them before the Fire, they would after a ſhort Time nimbly creep about, and be gone, if the Glaſs which I whelmed upon them, had not ſecured them.

2. It hath indeed been noted by a very wiſe Philoſopher, in Contradiction to our *Engliſh* Proverb, which ſays, that *A green Chriſtmas makes a fat Church-yard*; that the laſt Plague broke out here at *London*, after a long and ſevere Winter 1665. But I reply, That that was accidentally only, for that Diſeaſe is never bred amongſt us, but comes to us by Trade and Infection, 'Tis properly a Diſeaſe of *Aſia*, where it is Epidemical. And therefore, by the Providence of God, we are very ſecure from any ſuch Calamities as the natural Effect of our Climate. But we are not to judge or prognoſticate of the Salubrity or Sickneſs of a Year, from foreign Diſeaſes, but the raging of ſuch as are natural to the Men of our Climate.

By Mr. Edm. Halley, n. 181. p. 110.

2. To account for the different Heights of the Mercury at ſeveral times, 'twill not be unneceſſary to enumerate ſome of the principal Obſervations made upon the Barometer.

The firſt is, That in calm Weather, when the Air is inclined to Rain, the Mercury is commonly low.

2. That in ſerene good ſettled Weather, the Mercury is generally high.

3. That upon very great Winds tho' they be not accompanied with Rain, the Mercury ſinks loweſt of all, with Relation to the Point of the Compaſs the Wind blows upon.

4. That *Cæteris Paribus*, the greateſt Heights of the Mercury are found upon Eaſterly, and North-eaſterly Winds.

5. That in calm froſty Weather the Mercury generally ſtands high.

6. That after very great Storms of Wind, when the Quick-ſilver has been low, it generally riſes again very faſt.

7. That the more northerly Places have greater Alterations of the Baroſcope than the more ſoutherly.

8. That within the *Tropicks*, and near them, thoſe Accounts we have had from others, and my own Obſervations at St. *Helena*, make very little or no Variation of the Height of the Mercury in all Weathers.

Hence I conceive, that the principal Cauſe of the Riſe and Fall of the Mercury, is from the variable Winds, which are found in the *Temperate Zones*, and whoſe great Unconſtancy here in *England*, is moſt notorious.

A ſecond Cauſe is the uncertain Exhalation and Precipitation of the Vapours lodging in the Air, whereby it comes to be at one Time much more crouded than at another, and conſequently heavier; but this latter in a great Meaſure depends upon the former. Now from theſe Principles, I ſhall endeavour to explicate the ſeveral *Phænomena* of the Barometer, taking them in the ſame Order I laid them down. Thus,

1. The Mercury's being low, inclines it to Rain, becauſe the Air being light, the Vapours are no longer ſupported thereby, being become ſpecifically heavier than the Medium wherein they floated, ſo that they deſcend towards the Earth, and in their Fall, meeting with other aqueous Particles, they in-

corporate together and form little drops of Rain; but the Mercury's being at one time Lower than at another is the effect of two Contrary Winds blowing from the place where the Barometer ſtands; whereby the Air of that place is carried both ways from it, and conſequently the incumbent Cylinder of Air is diminiſhed, and accordingly the Mercury Sinks; as for inſtance, if in the *German Ocean* it ſhould blow a gale of weſterly Wind, and at the ſame time an eaſterly Wind in the *Iriſh Sea*; or if in *France* it ſhould blow a northerly Wind, and in *Scotland* a Southerly; it muſt be granted me that that part of the Atmoſphere impendent over *England*, would thereby be exhauſted and attenuated, and the Mercury would ſubſide, and the Vapours which before floated in thoſe parts of the Air of equal Gravity with themſelves, would ſink to the Earth.

2. The greater Height of the Barometer is occaſioned by two contrary Winds blowing towards the place of Obſervation, whereby the Air of other places is brought thither and accumulated; ſo that the incumbent Cylinder of Air being increaſed both in height and weight, the Mercury preſſed thereby muſt needs riſe and ſtand high, as long as the Winds continue ſo to blow, and then the Air being ſpecifically heavier, the Vapours are better kept ſuſpended, ſo that they have no inclination to precipitate and fall down in drops, which is the reaſon of the Serene good Weather, which attends the greater Heights of the Mercury.

3. The Mercury ſinks the Loweſt of all by the very rapid Motion of the Air in ſtorms of Wind. For the Tract or Region of the Earth's Surface, wherein theſe Winds rage, not extending all round the Globe, that ſtagnant Air which is left behind, as likewiſe that on the ſides, cannot come in ſo faſt as to ſupply the Evacuation made by ſo ſwift a Current, ſo that the Air muſt neceſſarily be attenuated when and where the ſaid Winds continue to blow, and that more or leſs according to their violence; add to which that the *Horizontal* motion of the Air being ſo quick as it is, may in all probability take off ſome part of the perpendicular preſſure thereof; and the great agitation of its particles is the reaſon why the Vapours are diſſipated, and do not condenſe into drops ſo as to form Rain, otherwiſe the natural conſequence of the Air's Rarefaction.

4. The Mercury ſtands the higheſt upon an Eaſterly or North-eaſterly Wind, becauſe in the great *Atlantick Ocean*, on this ſide the 35th *Deg.* of North Latitude, the Weſterly and South-weſterly Winds blow almoſt always Trade, ſo that whenever here the Wind comes up at Eaſt and North-eaſt 'tis ſure to be check'd by a contrary gale, as ſoon as it reaches the Ocean; wherefore, according to what is made out in our ſecond Remark, the Air muſt needs be heaped over this Iſland, and conſequently the Mercury muſt ſtand high as often as theſe Winds blow. This holds true in this Country, but is not a general Rule for others where the Winds are under different circumſtances; and I have ſometimes ſeen the Mercury here as low as 29 inches upon an Eaſterly Wind, but then it blew exceeding hard, and ſo comes to be accounted for by what was obſerv'd upon the third Remark.

5. In Calm Froſty Weather the Mercury generally ſtands high, becauſe (as I conceive) it ſeldom freezes but when the Winds come out of the

Northern and North-eaſtern Quarters, or at leaſt unleſs thoſe Winds blow at no great diſtance off; for the Northern parts of *Germany*, *Denmark*, *Sweden*, *Norway*, and all that Tract from whence North-eaſtern Winds come, are ſubject to almoſt continual Froſt all the Winter; and thereby the lower Air is very much condenſed, and in that ſtate is brought hitherwards by thoſe Winds, and being accumulated by the Oppoſition of the weſterly Wind blowing in the *Ocean*, the Mercury muſt needs be preſt to a more than ordinary Height; and as a concurring Cauſe, the Shrinking of the lower parts of the Air into leſſer Room by Cold, muſt needs cauſe a deſcent of the upper parts of the Atmoſphere to reduce the Cavity made by this contraction to an *Æquilibrium*.

6. After great Storms of Wind, when the Mercury has been very Low, it generally Riſes again very Faſt; I once obſerved it to riſe 1½ inch in leſs than 6 Hours after a long continu'd Storm of South-weſt Wind. The reaſon is, becauſe the Air being very much rarified, by the great Evacuations which ſuch continued Storms make thereof, the Neighbouring Air runs in the more ſwiftly to bring it to an *Æquilibrium*; as we ſee Water runs the faſter for having a great declivity.

Equilibre des Liqueurs. 7. The Variations are greater in the more Northerly places, as at *Stockholm* greater than at *Paris* (compared by M. *Paſcall*) becauſe the more Northerly parts have uſually greater ſtorms of Wind than the more Southerly, whereby the Mercury ſhould ſink lower in that extream; and then the Northerly Winds bringing the Condenſed and Ponderous Air from the Neighbourhood of the *Pole*, and that again being checked by a Southerly Wind at no great diſtance, and ſo heaped, muſt of Neceſſity make the Mercury in ſuch caſe ſtand higher in the other extream.

8. Laſtly, This Remark, That there is little or no Variation near the *Equinoctial*, does above all others confirm the *Hypotheſis* of the variable Winds being the Cauſe of theſe Variations of the Height of the Mercury, for in the places above named there is always an eaſy gale of Wind blowing nearly upon the ſame point, *viz.* *E.N.E.* at *Barbadoes*, and *E.S.E.* at St. *Helena*, ſo that there being no contrary currents of the Air to exhauſt or accumulate it, the Atmoſphere continues much in the ſame State: However upon Hurricanes (the moſt violent of Storms) the Mercury has been obſerved very Low, but this is but once in two or three Years, and it ſoon recovers its ſettled ſtate of about 29½ Inches.

The Principal Objection againſt this Doctrine is, that I ſuppoſe the Air ſome-times to move from thoſe Parts where it is already evacuated below the *Æquilibrium*, and ſometimes again towards thoſe Parts where it is condenſed and crouded above the mean State, which may be thought contradictory to the Laws of *Staticks* and the Rules of the *Æquilibrium* of Fluids. But thoſe that ſhall conſider how when once an *Impetus* is given to a Fluid Body, it is capable of mounting above its Level, and checking others that have a contrary tendency to Deſcend by their own Gravity, will no longer regard this as a material Obſtacle; but will rather conclude, That the great Analogy there is, between the Riſing and Falling of the Water upon the *Flux* and *Reflux* of the Sea, and this of accumulating and extenuating the Air, is a great Argument for the Truth of this *Hypotheſis.* For as the Sea, over againſt the Coaſt of *Eſſex,* riſes and ſwells by the meeting of the two contrary Tides of Flood, whereof the one comes from the *S. W.* along the *Channel* of *England,* and the other from the North; and on the contrary ſinks below its Level upon the retreat of the Water both ways, in the Tide of Ebb; ſo it is very probable, that the Air may Ebb and Flow, after the ſame manner; but by reaſon of the diverſity of Cauſes, whereby the Air may be ſet in moving, the Times of theſe *Fluxes* and *Refluxes* thereof are purely caſual, and not reducible to any Rule, as are the Motions of the Sea, depending wholly upon the regular courſe of the *Moon.*

XI. 1 The Experiment is briefly this; that a Tube being after the *Torricellian* way filled with Mercury, and before Inverſion perfectly purged of Air, doth when inverted remain top full, even to the Height of 75 inches.

M. *Hugens,* to render a probable Cauſe of this ſtrange Effect, conceiveth That, beſides the Preſſure of the Air which keeps the Mercury ſuſpended at the Height of about 27 inches, (and of the Truth of which we are convinced by a great Number of other Effects that we ſee) there is yet another Preſſure, ſtronger than that, of a more ſubtile matter than Air, which without difficulty penetrates Glaſs, Water, Quick-ſilver, and all other Bodies, which we find impenetrable to Air. This Preſſure he ſaith, being added to that of the Air, is capable to ſuſtain the 75 inches of Mercury, and poſſibly more, as long as it Works only againſt the lower ſurface, or againſt that of the Mercury, in which ſtands the open End of the Tube: But as ſoon as it can work alſo on the other ſide, (which happens when ſtriking or hiting againſt the Tube, or intromitting into it a ſmall Bubble of Air, you give way to this matter to begin to act) the Preſſure of it becomes equal on both ſides, ſo that there is no more but the Preſſure of the Air which ſuſtains the Mercury at the ordinary Height of 29 inches.

The Cauſe of the Suſpenſion of the Mercury at an Unuſual Height, by M. Hugens. n. 86. p. 5027.

If you ask, why the Quick-ſilver in the Tube of this Experiment does not feel the Preſſure of this Matter even whilſt that Veſſel is yet full; ſince M *Hugens* ſuppoſeth, that it pierceth without Difficulty the Glaſs as well as the Mercury, *&c*? And why the particles of this Matter do not joyn together and begin the Preſſure, in regard that they go and come thorow the whole Extent of the Mercury, and that the Glaſs does not hinder their Communication with thoſe that are without?

To remove this Difficulty, which in M. *Hugens*'s own Opinion is very great, he anſwers, That though the parts of the Matter, by him ſuppoſed, do find paſſage between thoſe that compoſe the Glaſs, Quick-ſilver, *&c.* yet they there find not ſufficiently large ones for many to paſs together, nor to move there with that force which is requiſite to ſeparate the parts of the Quick-ſilver, that have ſome Connexion together. And this very ſame Connexion, he ſaith, is the Cauſe that though on the ſide of the inner Surface of the Glaſs, which touches the ſuſpended Mercury, many of its parts be preſſed by the Particles of this Matter; yet there being alſo a great Number of them that feel no Preſſure, by reaſon of the Parts of the Glaſs, behind which they are placed, they retain one another, and they remain all ſuſpended, becauſe there is much leſs Preſſure on the Surface of the Quick-ſilver that is contiguous to the Glaſs, than upon that below, which is all expoſed.

expoſed to the Action of that Matter which makes this ſecond Preſſure.

The Ingenious and Candid Author of this Solution acknowledges himſelf, That it doth not ſo fully ſatisfie him, as not to leave ſome Scruple behind; but then he adds, That that keeps him not from being very well aſſured of that new Preſſure, which he hath ſuppoſed beſides that of the Air, by Reaſon as well of the Experiment already alledged, as of two others; which he ſubjoyns to this Effect.

Firſt, When two Plates of Metal or Marble whoſe Surfaces are perfectly plain, are put one upon another, they do ſo ſtick together, that the uppermoſt being lifted up, the undermoſt follows without quitting it: And the Cauſe hereof is juſtly aſcribed to the Preſſure of the Air againſt their two External Surfaces. He taking then two Plates, each of them but about an inch Square, being of that Matter of which anciently they made Looking Glaſſes, and cloſing them ſo exactly together that without putting any thing between the uppermoſt keeps not only up the other, but ſometimes alſo with it 3 Pounds of Lead faſten'd to the lowermoſt; and thus they remain together as long as you pleaſe. Having thus joyned them, and Charged them with 3 Pounds Weight, he ſuſpended them in the Recipient of his Engin, and Exhauſted it of Air ſo far as that there remained not enough to ſuſtain by its Preſſure as much as an inch height of Water, and yet his Plates disjoined not. He adds, that he made the ſame Experiment by putting Spirit of Wine between the two Plates; and found that in the Recipient evacuated of Air they ſuſtained, without being ſevered, the ſame weight they did when it was full of Air. This he thinks ſhews clearly enough, that there remains yet in the Recipient a Preſſure great enough after that of the Air is thence taken away; and that there is no more Reaſon to doubt of it, than of the Preſſure of the Air it ſelf.

The *Second* Experiment is, That whereas the Effect of a Siphon of unequal Legs, by which you make the Water of a Veſſel to run over, is no longer aſcribed to a *Fugæ Vacui*, but to the Weight of the Air which preſſing upon the Water of the Veſſel makes it Riſe in the Siphon, whilſt on the other ſide it deſcends by its Weight; Mr. *Hugens* found a Means to make the Water of the Siphon run after that the Recipient was exhauſted of Air, and he ſaw that with Water purged of Air it did the Effect as well as without the Recipient. The ſhorteſt of the Legs of the Siphon was 8 inches long, and its Aperture, of two Lines. And he will not have us doubt whether the Recipient was well exhauſted of Air, for he did aſſure himſelf of that, as well by finding that there came out no more Air through the Pump, as by other more certain Marks.

And this he takes for a farther Confirmation of his Suppoſition of a preſſing Matter more ſubtile than the Air. To which he adds, That if you take the Pains of ſearching, to what Degree the Force of this Preſſure reacheth, (which he ſaith cannot be better made than by purſuing the Experiment with Tubes full of Mercury yet longer than thoſe employed by Mr. *Boyle*) it will perhaps be found, that this force is great enough to cauſe the Union of the parts of Glaſs, and of other ſorts of Bodies, which hold too well together as not to be conjoyned but by their Contiguity and Reſt, as M. *Des Cartes* would have it.

2. I have given an account of this odd *Phænomenon* in my Treatiſe *de Motu*, *Cap.* 14. *Schol. Prop.* 13. where I hinted two Reaſons (though not perfectly ſatisfied in either:) The one of my own, concerning the Spring of the Air neceſſary to put heavy Bodies in Motion, not impelled by any other force: The other, of my L. *Brounker*, That there might be in the Air yet a greater Weight or Preſſure than is neceſſary for the Height of 29 inches, in Caſe there be nothing but the bare Weight of Quick-ſilver to be ſupported. I find M. *Hugens* to fall in with that of my L. *Brounker*, ſave that what we comprehend under the Name of Air, he calls a more Subtile Matter: Which alters not the Caſe at all, but only the Name. *By Dr. J. Wallis, n. 91. p. 5160.*

But ſurely there muſt be ſomewhat more than this Subtile Matter, to ſolve the *Phænomenon*, notwithſtanding the two Experiments now alledged by M. *Hugens* in favour of it. For, if this Matter be ſo Subtile as to preſs through the top of the Glaſs upon the Quick-ſilver, (and conſequently through the upper upon the neather of the two Marbles,) as is acknowledged (and without which it is no more able to precipitate the Quick-ſilver while impure, and when it is in part ſubſided, than when it is pure, and the Tube top full:) I do not ſee, why it ſhould not Balance it ſelf (above and below) in the ſame manner as Common Air would do, if the Tube were pervious to it at both Ends, and the Quick-ſilver, by the Preponderance of its own Weight fall preſently. And the anſwer, That though Glaſs be penetrated by it, yet not in ſo copious a manner as where no Glaſs is; doth not to me ſolve the Difficulty: Becauſe the ſame Obſtacle doth juſt in the ſame manner remain, when the Tube is in part emptied; and when the Quick-ſilver is unpurged; the Pores of the Glaſs not being, by either of thoſe, made more open or more pervious. And if we ſuppoſe the Subtile Matter by Percolation to be ſtrained through with ſome Difficulty, (as Air or Water would be through a Cloth,) this might poſſibly cauſe the Quick-ſilver, when it does ſink, to ſink gradually; but not (as we ſee it) ſuddenly to fall to the height of 29 inches.

The Connexion or Cohæſion of the parts of Quick-ſilver, either each to other, or to the ſides of the Glaſs, which M. *Hugens* ſuppoſeth to require for their Separation a greater Force than is in theſe percolated Particles till they have Room made for them to Combine; ſeems to me the leſs conſiderable, becauſe it is not ſo neceſſary to ſeparate them from each other, ſince that they may unſeparated ſlide down by the ſides of the Glaſs; to which it is well known, and viſible to the Eye, the Quick-ſilver is not at all apt to ſtick, but doth rather decline that Contact; in like manner as we find Water not apt to joyn with Oil or Greaſe; though Water to Glaſs, and Quick-ſilver to Gold, do very readily apply themſelves. So that there needs no ſuch Force to disjoyn the Quick-ſilver from the Glaſs, whatever there may be for disjoyning its parts one from another.

If therefore we ſhould ſuppoſe the Preſſure of the groſſer Air downwards on *A B* (the Surface of the Stagnant Quick-ſilver,) and conſequently by Means thereof upwards at *C*, ſufficient only to bear up that in the Tube to the height of *I*; but the ſuperadded Weight or Preſſure of the Purer Air to hold it up as high as *D*, (75 inches or more) while it is full *Fig. 7.*

and

and the Quick-ſilver well cleanſed, as if ſo long it could not enter at *D*; but in Caſe it be not ſo cleanſed or be already ſunk to *H* this Purer Air would enter at *D*, and thruſt it down to *I*, Counterbalancing the Preſſure (at *C*) of the Purer but not of the Groſſer Air (which I take to be the Sum of the Cauſe aſſign'd by M. *Hugens* :) I am yet to ſeek, why it may not as well penetrate *D* at firſt, to begin the Deſcent, as afterwards to purſue it; and why not as well begin the Deſcent when the Quick-ſilver is well cleanſed of Air, as when it is not ſo; and why alſo, if the Pure Air do freely enter at *D*, it does not preſently fall; or, if not freely, why, when it does fall, it falls ſuddenly and not leiſurely from *D* to *I*; eſpecially ſince ſo ſmall a Weight as *D H* of pure Air (for the Groſſer cannot enter,) is very inconſiderable; if not at all, or not freely, preſſed by that Incumbent on *D*; and the Adhæſion not conſiderably leſs, by being ſeparated only at the Top, while it yet continues to touch the Sides.

I am apt therefore, as heretofore, to adſcribe the Cauſe of this *Phænomenon* to the Spring that is in Air, and the want thereof in Quick-ſilver; For, that in Air there is a Spring or Elaſticity, is now undoubted; but in Water cleanſed of Air, though many Experiments have been attempted to that purpoſe, it has not yet been found that there is any: And I am apt to think the like of Quick-ſilver; though I do not know that this has been yet ſo rigorouſly examin'd. Now ſuppoſing, That Matter being at Reſt will ſo continue till it be put in Motion by ſome Force; this Force may be either that of Percuſſion from ſome Body already in Motion (which is the Caſe when the Quick-ſilver falls by ſhaking, or ſtriking the Tube,) or of Pulſion from a Contiguous Body beginning to move, as by the Expanſion of ſome adjacent Spring, (which is the Caſe when the Springy parts of the Air, either left in unpurged, or readmitted in the Quick-ſilver, by expanding themſelves put the Quick-ſilver in Motion;) or ſome *Conatus* or Endeavour of its own, ſuch as is that of a Spring, from whatever Cauſe it be, which I do not here enquire, but has place only in Springy Bodies, and therefore if Water and Quick-ſilver be not ſuch, they will not on this Account put themſelves in Motion.

Gravity or Heavineſs is reputed to be ſuch a *Conatus* or Pronity to move downwards, and ſo to put it ſelf in Motion: And the wonder at preſent is why it does not ſo here. But if this which we call Gravity ſhould chance to be not a Poſitive Quality or *Conatus* originally of it ſelf, but only the Effect of ſome Pulſion or Percuſſion from without, (which poſſibly may be the Caſe; and principally from the Spring of the Air about us) then while this Pulſion and Percuſſion is wanting (however Obviated) the Bodies accounted heavy, will not of themſelves begin to fall; which ſeems to be the preſent Caſe.

And this is the more Conſiderable, becauſe we cannot, at leaſt not yet, find, what is the utmoſt Height at which the Quick-ſilver thus accumulated will remain ſuſpended; there having been, for ought I know, no Height yet attempted, at which, if cleanſed, it will not ſtand; and that of 75 inches, conſidering the Weightineſs of Quick-ſilver, is a very great one, being more than Equivalent to 80 Foot of Water.

My Lord *Brounker* doth a little alter the Caſe, from what I take to be the *Hypotheſis* of M. *Hugens*. For he ſuppoſeth this Purer part of the Air to be of like Nature with the Groſſer part, (which I think M. *Hugens* doth not) and, though Finer than the reſt, ſo as to penetrate Glaſs, which the Groſſer will not (there being in all ſorts of Grains, ſome greater than others, and which will not paſs ſo fine a ſieve) yet of a Springy nature, as the groſſer parts are: Which therefore Acts, not by its Weight only, but by its Spring; and therefore when once entered, though in a ſmall Proportion, acts as effectually at its firſt Entrance as if the whole incumbent Air had Admiſſion; its Spring being of a like Tenſure with that of the outward Air; (as I have heretofore ſhewed, *Cap.* 14. *De Motu*, *Prop.* 11, 12, 13.) but M. *Hugens*'s more Subtile Matter than Air, though he muſt allow it Weight, for elſe its Entrance would be nothing to the Purpoſe, yet whether he allow it a Spring, I cannot tell; nor doth he Inform us. And when he ſays, this more Subtile Matter than Air doth without Difficulty Penetrate Glaſs, Water, Quick-ſilver, and all other Bodies, which we find Impenetrable to Air, I know not whether he mean, without any Difficulty, as the Words ſeem to import, or, as I conjecture by what follows, without great Difficulty, though with ſome.

But his *Lordſhip*, if I miſtake not, though he allows his Springy, Subtile Matter to penetrate Glaſs, yet not without Difficulty, and till it have ſome Room made, as *H D*, wherein it may recollect it ſelf, cannot exert its Spring; and therefore not while top full of cleanſed Quick-ſilver, but ſo ſoon as ſome Room is made for it: Whereas if the Quick-ſilver be not purged of Air, that little Air remaining doth by its Spring begin the Motion.

He thinks it alſo not improbable, and if it ſo prove, it will be a good Confirmation of this *Hypotheſis*, that a large but low Tube of Glaſs (ſhorter than 29 Inches) may ſtand top full of Quick-ſilver, though with a ſmall Hole in the top as at *K*; at leaſt if immerged in Water, in Caſe Air be too ſubtile for our Mechanicks.

He might alſo, ſuitably enough to his own *Hypotheſis*, have ſo explained himſelf as to allow his more ſubtile parts of common Air to penetrate Quick-ſilver but not Glaſs; and therefore, in Caſe of Room for it at *H D*, it might through the Stagnant Quick-ſilver, and that at *C*, paſs upwards to *H D*, and there exert its Spring.

There is yet another way of explicating the ſame *Hypotheſis*, without allowing this Subtile Matter to pierce the Glaſs; which is this. Our Common Air being an Aggregate of very Heterogeneous parts, we may well ſuppoſe ſome of them to be Springy, and others not to be ſo. The Springy parts we may conceive to be ſo many Conſiſtent Bodies, like ſmall Heirs or Springy Threads wrapped up in Different Forms and variouſly intangled, and ſo as to form many Vacuities capable of admitting (what the other parts of the Air may be ſuppoſed to be) ſome Fluid Matter, which may inſinuate into thoſe Vacuities (as Water in a Bundle of Ruſhes,) without diſturbing the Texture of thoſe Springy parts; and which may preſs as a Weight, but not as a Spring, (of which Diſtinction ſee *Cap.* 14. *De Motu*, *Schol. Prop.* 11. & *Schol. Prop.* 13. *p.* 729, 730, 732, 733.) Now if in the *Torricellian* Tube there be a Quantity of ſuch Springy Matter, the Spring

hereof

hereof will be of equal ſtrength with that of External Air, (and therefore able to Counterbalance it, though its weight be much leſs,) becauſe admitted with ſuch a Tenſure, (*ibid. Prop.* 12, 13.) But if only an unſpringy Fluid (which preſſeth but as a Weight not as a Spring) and this defended by the Glaſs Tube from any other Preſſure, ſave that of its own Weight; it will ſtill be too weak to force its own way, till its ſingle Weight be Equivalent to that which it is to Encounter; which is, not only the Springy part of the Air, but alſo that Fluid Unſpringy part; which though (becauſe Fluid) it would give way to a Springy Body preſſing through it; yet not to this Fluid, like it ſelf, and deſtitute of ſuch a Spring; and is therefore able to keep it up to a much greater Height than it could do if Uncleanſed of Springy Air: So long, at leaſt, as till ſome Springy Body be admitted, or ſome Concuſſion Equivalent to it, put it in Motion; but being once in Motion, it will ſo continue (as a Bullet impelled by Gun Powder, or an Arrow out of a Bow,) till ſtopped by ſome Poſitive Force Equivalent.

Vid. Inf. § Penult.

I do not deny, but that this Explication may be ſubject to ſome Difficulties and Exceptions; but I think, fewer than that of allowing the Glaſs penetrable by this Subtile Matter. But the beſt way to ſettle this Buſineſs, is by ſuitable Experiments.

A Statical Baroſcope; by Mr. Boyle, n. 14. p. 231.

XII. I cauſed to be blown at the Flame of a Lamp ſome Glaſs-bubbles, as Large, Thin, and Light, as I could then procure, and chooſing amongſt them one, that ſeemed the leaſt unfit for my turn (being of the bigneſs of a ſomewhat large Orange, and weighing about 1. *Dr.* and 10. *gr.*) I counterpoiſed it in a pair of Scales, that would looſe their *Æquilibrium* with about the 30*th* part of a grain, and were ſuſpended at a Frame. I placed both the Balance and the Frame by a good Baroſcope, from whence I might learn the preſent weight of the Atmoſphere. Then leaving theſe Inſtruments together, though the Scales, being no nicer than I have expreſſed, were not able to ſhew me all the Variations of the Air's weight that appeared in the Mercurial Baroſcope, yet they did what I expected, by ſhewing me Variations no greater than altered the height of the Quick-ſilver half a quarter of an inch, and perhaps much ſmaller than thoſe. I had the pleaſure to ſee the Bubble ſometimes in an *Æquilibrium* with the counterpoiſe; ſometimes when the Atmoſphere was high preponderate ſo manifeſtly, that the Scales being gently ſtirr'd, the Cock would play altogether on that ſide, at which the Bubble was hung; and at other times (when the Air was heavier) that, which was at the firſt but the Counterpoiſe, would preponderate, and upon the Motion of the Balance make the Cock vibrate altogether on its ſide. And this would continue ſometimes many Days together, if the Air ſo long retained the ſame meaſure of Gravity; and then (upon other changes) the Bubble would regain an *Æquilibrium*, or a preponderance; ſo that I had oftentimes the ſatisfaction by looking firſt upon the ſtatical Baroſcope (as for diſtinctions ſake it may be called) to foretel, whether in the Mercurial Baroſcope the Liquor were High or Low.

If the ground, on which I went in framing this Baroſcope, be demanded, the Anſwer in ſhort may be; 1. That though the Glaſs Bubble, and the Braſs counterpoiſe at the time of their firſt being weighed be in the Air wherein they both are weigh'd, exactly of the ſame weight; yet they are nothing near of the ſame bulk, the Bubble by reaſon of its Capacious Cavity (which contains nothing but Air, or ſomething that weighs leſs than Air) being perhaps a hundred or two hundred times bigger than the Metalline Counterpoiſe. 2. That according to the Hydroſtatical Laws, if two Bodies of equal Gravity but unequal Bulk come to be weighed in another Medium, they will be no longer equiponderant; but if the new Medium be heavier, the greater Body, as being lighter in Specie, will loſe more of its Weight than the leſſer and more compact; but if the new Medium be lighter than the firſt, then the bigger Body will out-weigh the leſſer: And this Diſparity ariſing from the Change of Mediums, will be ſo much the greater, by how much the greater Inequality of Bulk there is between the Bodies formerly equiponderant. 3. That, laying theſe two together, I conſidered that 'twould be all one, as to the Effect to be produced, whether the Bodies were weighed in Mediums of differing Gravity, or in the ſame Medium, in Caſe its ſpecifick Gravity were conſiderably alter'd: And conſequently, that ſince it appeared by the Baroſcope, that the Weight of the Air was ſometimes heavier and ſometimes lighter, the Alterations of it in Point of Gravity, from the Weight it was of at firſt counterpoiſing of the Bubble of it, would unequally affect ſo large and hollow a Body as the Bubble, and ſo ſmall and denſe an one as a Metalline Weight: and when the Air by an Encreaſe of Gravity ſhould become a heavier Medium than before, it would buoy up the Glaſs more than the Counterpoiſe; and if it grew lighter than it was at firſt, would ſuffer the former to preponderate.

One Morning early being told of a Miſt, I ſent to ſee whether it made the Air ſo heavy as to buoy up the Bubble; but I did not learn, that that Miſt had any ſenſible Operation on it.

Though a ſingle Bubble of competent Bigneſs be much preferable, by reaſon that a far leſs Quantity and Weight of Glaſs is requiſite to compriſe an equal Capacity, when the Glaſs is blown into a ſingle Bubble, than when it is divided into two; yet I found that the imploying of two inſtead of one, did not ſo ill anſwer my Expectations, but that they may for a need ſerve the Turn inſtead of the other, than which they are more eaſy to be procured: and if the Balance be ſtrong enough to bear ſo much Glaſs, without being injured, by employing two, or a greater Number of large Bubbles, the Effect may be more conſpicuous, than if only a ſingle Bubble (though a very good one) were employed.

This Inſtrument may be much improv'd by divers Accommodations. As,

1. There may be fitted to the *Anſa* (or Cheek of the Balance) an Arch of a Circle divided into 15 or 20 *Deg.* (more or leſs, according to the Goodneſs of the Balance) that the Cock, reſting over againſt theſe Diviſions, may readily, and without Calculation ſhew the Quantity of the Angle, by which when the Scales propend either way, the Cock declines from the Perpendicular; and the Beam from its *Horizontal* Paralleliſm.

2. Thoſe that will be ſo curious, may inſtead of the ordinary Counterpoiſe (of Braſs) employ one of Gold, or at leaſt of Lead, whereof the latter being of equal Weight with Braſs is much leſs in Bulk, and the former amounts not to half its Bigneſs.

3. Thoſe Parts of the Balance, that may be made of Copper or Braſs, without any Prejudice to the Exactneſs; will by being made of one of thoſe Metals be leſs ſubject than Steel, (which yet if well hardned and poliſhed may laſt good a great while) to ruſt with long ſtanding.

4. Inſtead of the Scales, the Bubble may be hung at one End of the Beam, and only a Counterpoiſe to it at the other, that the Beam may not be burthened with unneceſſary Weight.

5. The whole Inſtrument, if placed in a ſmall Frame like a ſquare Lanthorn with glaſs Windows, and a Hole at the Top for the Commerce of the internal and external Air, will be more free from Duſt, and irregular Agitations; to the latter of which it will otherwiſe be ſometimes incident.

6. This Inſtrument being accommodated with a light Wheel and an Index (ſuch as have been applied by the excellent Dr. *Chr. Wren* to open Weather-Glaſſes, and by the ingenious Mr. *Hook* to Baroſcopes) may be made to ſhew much more minute Variations than otherwiſe.

7. And the Length of the Beam and Exquiſiteneſs of the Balance, may eaſily, without any of the foregoing Helps (and much more with them) make the Inſtrument far exacter than any of thoſe I was reduced to employ. And to theſe Accommodations divers others may be ſuggeſted by a farther Conſideration of the Nature of the Thing, and a longer Practice.

Tho' in ſome Reſpects this ſtatical Baroſcope be inferior to the Mercurial; yet in others it has its own Advantages and Conveniences above it.

And 1. It confirms *ad Oculum* our former Doctrine, that the Falling and Riſing of the Mercury depends upon the varying Weight of the Atmoſphere; ſince in this Baroſcope it cannot be pretended, that a *Fuga Vacui*, or a *Funiculus*, is the Cauſe of the Changes we obſerve. 2. It ſhews that not only the Air has Weight, but a more conſiderable one, than ſome learned Men, who will allow me to have proved it has ſome Weight, will admit; ſince even the Variation of Weight in ſo ſmall a Quantity of Air, as is but equal in Bulk to an Orange, is manifeſtly diſcoverable upon ſuch Balances as are none of the niceſt. 3. This ſtatical Baroſcope will oftentimes be more parable than the other; for many will find it more eaſy to procure a pair of good gold Scales and a Bubble or two, than a long Cane ſeal'd, a Quantity of Quick-ſilver, and all the other Requiſites of the Mercurial Baroſcope; eſpecially if we compriſe the Trouble and Skill that is requiſite to free the deſerted part of the Tube from Air. 4. And whereas the Difficulty of removing the Mercurial Inſtrument has kept Men from ſo much as attempting to do it even to neighbouring Places; the eſſential Parts of the Scale Baroſcope (for the Frame is none of them) may very eaſily in a little Room be carried whither one will, without the Hazard of being ſpoiled or injured. 5. There is not in ſtatical Baroſcopes, as in the other, a Danger of Uncertainty, as to the Goodneſs of the Inſtruments, by Reaſon, that in theſe the Air is in ſome more, and in ſome leſs perfectly excluded; whereas in thoſe, that Conſideration has no Place (And by the way, I have ſometimes upon this Account been able to diſcover by our new Baroſcope, that an eſteemed Mercurial one, to which I compared it, was not well freed from Air.) 6. It being very poſſible to diſcover Hydroſtatically, both the Bigneſs of the Bubble, and the Contents of the Cavity, and the Weight and Dimenſions of the Glaſſy Subſtance, (which together with the included Air make up the Bubble) much may be diſcover'd by this Inſtrument, as to the Weight of the Air abſolute or reſpective. For when the Quick-ſilver in the Mercurial Baroſcope is either very high or very low, or at a middle Station between its greateſt and leaſt Height, bringing the Scale Barometer to an exact *Æquilibrium*, (with very minute Diviſions of a Grain) you may by watchfully obſerving when the Mercury is riſen or fallen juſt an Inch, or a fourth, or half an Inch, *&c.* and putting in the like minute Diviſions of a Grain to the lighter Scale, till you have again brought the Balance to an exquiſite *Æquilibrium*; you may, I ſay, determine what known Weight in the ſtatical Baroſcope anſwers ſuch determinate Altitudes of the aſcending and deſcending Quick-ſilver in the Mercurial And if the Balance be accommodated with a divided Arch, or a Wheel and Index, theſe Obſervations will aſſiſt you for the future to determine readily, by ſeeing the Inclination of the Cock, or the Degree marked by the Index, what Pollency the Bubble hath, by the Change of the Atmoſphere's Weight, acquired or loſt. 7: By this ſtatical Inſtrument, we may be aſſiſted to compare the Mercurial Baroſcopes of ſeveral Places, (tho' never ſo diſtant) and to make ſome Eſtimates of the Gravities of the Air therein. As if, for inſtance, I have found by Obſervation that the Bubble I employ weigh'd juſt a *Drachm*, when the Mercurial Cylinder was at the Height of 29½ inches, (which in ſome Places I have found a moderate Altitude) and that the Addition of the *16th* Part of a *gr.* is requiſite to keep the Bubble in an *Æquilibrium*, when the Mercury is riſen an *8th*, or any determinate Part of an Inch above the former Station: When I come to another Place, where there is a Mercurial Barometer, as well freed from Air as mine, for that muſt be ſuppoſed, if taking out my Scale Inſtrument, it appears to weigh preciſely a *Drachm*, and the Mercury in the Baroſcope ſtand at juſt 29½ Inches, we may conclude the Gravity of the Atmoſphere not to be ſenſibly unequal in both thoſe two Places, tho' very diſtant: And tho there be no Baroſcope there, yet if there be an Addition of Weight, as for Inſtance, the *16th* Part of a Grain, requiſite to be added to the Bubble, to bring the Scales to an *Æquilibrium*, it will appear that the Air at this ſecond Place is at that Time ſo much heavier than the Air of the former Place was when the Mercury ſtood at 29½ Inches.

But in making ſuch Compariſons, we muſt not forget to conſider the Situation of the ſeveral Places, if we mean to make Eſtimates not only of the Weight of the Atmoſphere, but of the Weight and Denſity of the Air. For though the Scales will ſhew, as has been ſaid, whether there be a Difference of Weight in the Atmoſphere at the two Places; yet if one of them be in a Vale or Bottom, and the other on the Top, or ſome elevated Part of a Hill, it is not to be expected, that the Atmoſphere, in this latter Place, ſhould gravitate as much as the Atmoſphere in the former, on which a longer Pillar of Air does lean or weigh.

And the mention I have made of the differing Situation of Places, puts me in Mind of ſomething that may prove another Uſe of our ſtatical Baroſcope.

roſcope; namely, that by exactly poiſing the Bubble at the Foot of a high Steeple or Hill, and carrying it in its cloſe Frame to the Top, one may, by the Weight requiſite to be added to the Counterpoiſe there to bring the Beam to its *Horizontal* Poſition, obſerve the Difference of the Weight of the Air at the bottom, and at the Top; and in Caſe the Hill be high enough, at ſome intermediate Stations: And perhaps when duly improv'd, it may aſſiſt Men to eſtimate the abſolute or comparative Height of Mountains, and other elevated Places of the Earth.

The Uſe of Barometers; by .... n. 122. p. 593.

XIII. By accurate Baroſcopes we may regain that Knowledge which ſtill reſides in Brutes and we forfeited by not continuing in the open Air, as they do for the moſt part, and by intemperance corrupting the Craſis of our Senſes.

Thermometers and Obſervations made with them; by Dr. J. Beal, n. 55. p. 1114.

XIV. 1. *Dec.* 26, 1669. in the Morning, the Weather was colder than ever I found it, ſince I could take it by the Meaſure of a Thermometer; that is ſince theſe 5 or 6 Years. It was very cold, and freezing quick ſome Days before and after: And yet in this Time the Mercury hath ſometimes fallen more than an Inch, without any other Change of Weather than ſome Guſts of Winds, ſome Sprinklings of Snow at ſeveral times, in all ſcarce enough to cover the Ground; and ſome Abatements of Cold, more eſpecially when the Sun was up. To note this Degree of Cold more particularly, I muſt acquaint you, that in my ſtanch Thermometer, on the ſaid 26 of *December* the Liquor was at 3½ inches: whereas in ordinary briſk Froſts, it is at 7 Inches. Yet here I muſt obſerve, that ſometimes the Froſt diſſolves, when it is at the *7th* Figure, andd ſometimes I find it at the 8th Figure, in a ſmart Froſt. 'Tis warm *May* Weather when tis at the 10*th* Figure, and 'tis not much above the 12*th* Figure in the hotteſt Weather of *June*, *July*, and *Auguſt*.

I think it remarkable, that the *7th* Inch, and ſometimes the 8th in my Thermometer ſhould abide freezing, and the Froſt increaſe till the Liquor deſcend 4½ Inches; and yet, that it ſhould not aſcend from the 8th Inch more, than 4½ Inches in our hotteſt Summer, being hung in the ſame Place within 18 Inches of the Glaſs Window, facing the Northweſt, and in a little writing Room in the 2*d*. Row of Buildings. But now I am ſtrongly perſwaded, that the Degrees of Heat and Cold are not exactly indicated by the incloſed Spirit of Wine: For when the Snow melted, and the Froſt was firſt diſſolved without Sun-ſhine, the Liquor was not above the Height of 5½ Inches; poſſibly it retains ſome part of the Cold a while after the Ambient Air becomes more tepid.

By Dr J. Wallis, n. 55. p. 1118.

2. My Thermoſcope was firſt made in *Dec.* 1664. the whole Height of the ſmall Cylindrick Glaſs, whoſe Cavity was about [illegible] of an Inch Diameter, was about 28 Inches; beſides a ſmall Spherical Bowl at the Top, of about ¾ of an Inch Diameter, and a Bowl at the Bottom, which contained the Liquor, (being Spirit of Wine tinged with Cochineal) of about 2 Inches Diameter: the Space above the Liquor being at the firſt Compoſure of it, void of Air, ſave what it had out of the Liquor, which being warm at the firſt putting in, filled the whole Cavity, while the Glaſs was Hermetically ſeal'd. I placed it ſo, as never to be expoſed to the Sun, but in a Room that has a Window only to the North; and therefore it gives an Account only of the Temperature

[illegible], 10. p. 169.

167.

perature of the Air in General, not of the immediate Heat of the Sunſhine. It is ſo nice, as that my being or not being in my Study, I find to vary its Height ſometimes almoſt ½ of an Inch.

The loweſt Mark to which ~~the~~ Liquor did ſubſide in *Jan.* and *Feb.* 166⅘, was at 12¼ Inches: at 14½ it was Froſt certain, and ſometimes at 15, and at 15½ (yet this I often obſerved, that the Air by the Thermoſcope has appeared conſiderably colder, and the Liquor lower, at ſometimes when there is no Froſt, than at ſome other times when the Froſt hath been conſiderably hard :) The greateſt Height in the Summer following was at 25, 26, 26½. n. 55. p. 1118. n. 10 p. 169.

In *Dec. Jan.* and *Feb.* 1665. we had at 14½ Froſt certain; ſometimes at 15 or higher; and the loweſt, to which it did that Winter deſcend, was 12½. The height in the following Summer 1666, was uſually about 19, 20, 21; the higheſt of all at 25. n. 55. p. 1118.

In *Dec.* and *Jan.* 1666, it was Froſt certain at about 13½, (an Inch lower than the Years before, the Liquor, it ſhould ſeem, becoming leſs ſpirituous) ſometimes at 14 or 14½, it was hard froſty Weather at 12, 11, and once at 10½, the Weather being very cold. The uſual Height in the Summer following, 1667, was about 19, 20, 21, and the higheſt at 24½.

The Winter following, 1667, it was ſcarce certain Froſt at 13; but yet ſometimes at 14, or a little higher: the loweſt, to which it did deſcend that Winter, (being very mild after *Chriſtmas*) was at 12. And the following Summer, 1668, uſually about 18, 19, 20; the higheſt of all (the Heat of that Summer being but very moderate,) at 22.

The next Winter it was froſt certain, about 12½; but ſometimes at 13, or higher: the loweſt of all at 10½. And in the Summer following, 1669, the higheſt of all (being but a cool Summer) not much above 20.

At *Chriſtmas*, 1669, though I found it to be Froſt certain about 12¾, and ſomething higher than 13; yet hath it come ſometimes lower than 8; and particularly *Dec.* 26, in the Morning to 7½, and did not all that Day come ſo high as 8 Inches. Which being ſo much lower than ever it had been in any of the precedent Years of my Obſervation, though it may in part be attributed to the diſpiriting of the Liquor, yet principally to the Extremity of the Cold. *Jan.* 1. when the Froſt ſeem'd to relent, it was ſomewhat higher than 9; and *Jan.* 7. about 12½.

A Thermometer obſerved at Sea, by Mr. Ja. Cunningham n. 264. p. 577.

3 The greateſt Height, the Spirit did riſe to in the Thermometer, was two Diviſions below extream hot, when we were near the *Equinoctial*.

The Expanſion of ſeveral Fluids, in Order to aſcertain the Diviſions of the Thermometer; by Mr. Edm. Halley. n. 197. p. 650.

XV. Since the ſame Degree of Heat does not proportionally expand all Fluids; ſome ſwelling with a gentle Warmth, and others not till they be conſiderably hot; ſome boiling with a moderate Heat, and others not at all; ſome capable of great Expanſion, others increaſing very little; it may well be concluded, that no one of them does increaſe and diminiſh in the ſame Proportion with the Heat, and conſequently, that the Thermometers graduated by equal Parts of the Expanſion of any Fluid, are not ſufficient Standards of Heat or Cold.

This will be more evident from the Experiments which I made in the Months of *Feb.* and *Mar.* about 4 Years ſince, the Weather being reaſonably cold and not freezing) with Water, Mercury, and Spirit of Wine, wherein the following Particulars were very remarkable.

1. I took a large Bolt-head, holding about 3¼ *lib.* of Water, with a narrow Neck to make the Augment thereof more ſenſible; and having filled it with Water, and ſome few Inches up the Neck, I noted exactly to what Mark the Water came; then I immerſed it into a Skillet of warm Water, and let it ſtand ſo long, till I concluded the warm Water had communicated its Temper to the Water included in the Bolt-head, and I found that tho' the Water were warm, much beyond the Degree of the Summer's Heat, and notwithſtanding it was Winter, yet that gentle Heat had ſcarce any Effect in dilating the Water, ſo that it ſcarce appeared to have aſcended in the neck of the Bolt-head. Then I took the Skillet, and ſet it over the Fire, when it was obſervable, that the Water as it grew hot did ſlowly aſcend in the Neck, eſpecially at firſt; but after it began to boil in the Skillet, the Expanſion thereof became more viſible, and it aſcended apace, till ſuch Time as it ſtopped again, the utmoſt Effort of boyling Water being able to raiſe it no higher. Then having made a Mark at the utmoſt Height whereto it had ariſen, I took it out, and had the Satiſfaction to obſerve, that tho' it was not raiſed ſo high without a very ſtrong boiling, yet it ſubſided very ſlowly, as retaining ſometime the Space it had acquired from the Heat, even after the Heat was paſs'd, and the Glaſs was ſo cool as to be touched without burning the Fingers. However the next Morning I found it reduced to the firſt Mark, where it ſtood when at firſt put in, having loſt nothing ſenſible by Evaporation during the Experiment, which I attribute to the length of the Neck wherein the Vapours were condenſed into Drops before they reached the Top. Then I examined how much Water would raiſe that in the Neck to the Mark whereto it had been encreaſed by boyling, and found it was a 26th part of the Bulk of the firſt Water, which upon repeated experiments I found to be true; but it was obvious that Water increaſing ſo very little with all the Degrees of Heat the Air receives from the Sun, was a very improper Fluid to make a Thermometer withal; and beſides any freezing Liquor is uſeleſs for this Purpoſe in theſe Northern Climates.

2. I took a ſmaller Bolt-head with a proportional Cane or Neck, and filled it after the ſame manner with Mercury, and having boiled it as above, I obſerved that 125 Ounces of Mercury had increaſed the Space of 810 Grains, or a 74*th* part of its bulk when cold. But it was very remarkable, that whereas a gentle Heat had ſcarce any Effect on Water, here on the contrary, the Mercury did ſenſibly aſcend at firſt, and had almoſt attained its greateſt Expanſion before the Water boiled in the Skillet. And after it boiled, tho' I let it ſtand very long over the Fire, I could not diſcern that the moſt vehement boyling had any Effect on it, above what appeared when it firſt began to boil. The Mercury being taken out, as it cooled ſubſided, and in a few Hours returned to the Mark whereat it ſtood before it was put into the Water. This Fluid being ſo ſenſible of a gentle Warmth, and withal not ſubject to evaporate without a good Degree of Fire, might moſt properly be applied to the Conſtruction of Thermometers, were it's Expanſion more conſiderable.

However, ſmall as it is, it is ſufficient to diſturb the preciſe Nicety of the Mercurial Barometers, ſhewing the Counterpoiſe of the Preſſure of the Atmoſphere by a Cylinder of Mercury; for if Mercury be more expanded, and conſequently lighter in warm Weather than in cold, it will neceſſarily follow, that the ſame Weight of Atmoſphere will require a taller Cylinder in Summer, and a ſhorter in Winter to counterpoiſe it. And if the Extremity of Weather do but occaſion a 15*th* Part of Difference, as 'tis probable it doth, the Effect thereof on a Barometer will be a tenth of an Inch above and below the Mean, or a Fifth in all.

3. I fill'd the ſmaller Bolt-head with Spirit of Wine, and having ſet it in the Skillet of Water over the Fire, I found that it aſcended gradually as the Heat increaſed, but ſlower at firſt, and faſter after it was well warm. At length being arrived at a certain Degree of Heat, it would fall a boyling with great Violence, emitting Bubbles, which coming into the Neck of the Bolt-head, would lift all the incumbent Spirits till they had made their way through. And theſe ſucceeding one another very faſt, would often raiſe the Spirit to the Top of the Neck, and ſpill it; ſo that I found I could go no further with this Liquor, than to that Degree of Heat which occaſioned this boyling, and which wanted very much of that of boiling Water, being almoſt tolerable to the Touch. It was however very remarkable, how exactly this degree of Heat was determined by the Expanſion of the Spirit, for in the inſtant it reached a certain Mark on the Neck, it began to emit its Bubbles: and having been taken out a little to cool and ſubſide, it would certainly and conſtantly fall a bubbling again, when upon a 2d Immerſion, it was arrived at the foreſaid Mark. During this Experiment, it appear'd both by the Dew on the Neck, and by the Scent in the Room, that tho' the Neck were about 30 Inches long, yet the Spirit did evaporate very faſt for the ſmallneſs of the Surface of the Liquor: And I have often noted the like Evaporations condenſed in Dew, within the Head of the ordinary ſeal'd Thermometers, in very hot Weather.

This degree of Heat which made Spirit of Wine begin to boil, being determined ſo nicely as I have ſaid, made me conclude, that this might very properly be taken for the Limit of the Scale of Heat in a Thermometer; and the Effect thereof in the Expanſion of any other Fluid being accurately noted, might be eaſily transferr'd to any ſort of Thermometer whatſoever. Only it muſt be obſerved, that the Spirit of Wine uſed to this purpoſe be highly Rectify'd or Diphlegmed, for otherwiſe the differing Goodneſs of the Spirit will occaſion it to boil ſooner or later, and thereby pervert the deſigned Exactneſs. And by the way, give me leave to hint, that the ſooner or later boiling of Spirit, or ſpirituous Liquors may poſſibly be s good a Teſt of their Strength and Perfection as their ſpecifick Gravity, r any other yet uſed.

The Spirit of Wine I made uſe of was poſſibly none of the beſt, but I obrved that at the point of boiling it had increaſed a 12*th* part in bulk, which reat Dilatation makes it a Liquor ſufficiently adapted to our purpoſe, were t not for the Evaporation thereof, and for the difference in goodneſs of the Spirit, and for that in length of Time it becomes as it were Effete, and loſes gradually a part of its expanſive Power.

4 This expanſive Power is in no Fluid comparably ſo conſpicuous as in that rare elaſtick Fluid the Air; for by ſeveral Experiments that I have made, I find that the Heat of Summer does expand the ordinary Air about a 30*th* part; and that late honourable Patron of Experimental Philoſophy, Mr. *Boyle*, alledges his own Tryals, proving that the Force of the ſtrongeſt Cold in *England* does not contract the Air above $\frac{1}{20}$ part. So that the ſame Air which in extreme Cold occupies 12 parts of ſpace, in very hot Summer Weather, will require 13 ſuch Spaces; which is as great an Expanſion as that of Spirit of Wine when it begins to boil: For which Reaſon, and for its being ſo very ſenſible of Warmth and Cold, and continuing to exert the ſame elaſtick Power after never ſo long being included, in my Opinion it is much the moſt proper Fluid for the purpoſe of *Thermometers*.

Hiſt. of Cold. Tit. 18. S. 8. p. 475.

Now the Thermometers hitherto in uſe are of two ſorts: the one ſhewing the different temper of Heat and Cold by the Expanſion of Spirit of Wine, the other by the Air: But I cannot learn that either of them of either ſort, were ever made or adjuſted, ſo as it might be concluded, what the Degrees or Diviſions of the ſaid Inſtruments did mean; neither were they ever otherwiſe graduated, but by Standards kept by each particular Workman, without any Agreement or Reference to one another: So that whatſoever Obſervations any curious Perſon may make by his Thermometer, to ſignify the Degree of Heat in the Air, or other Things, (which is of conſtant uſe in Philoſophical Matters) cannot be underſtood, unleſs by thoſe who have by them Thermometers of the ſame Make and Adjuſtment. Much leſs has the way been ſhown how to make this Inſtrument without a Standard, or to make two of them to agree artificially, without comparing them together.

I ſhall only add, that whereas the uſual Thermometers with Spirit of Wine, do ſome of them begin their Degrees from a Point, which is that whereat the Spirit ſtands when it is ſo cold as to freeze Oil of Anniſeeds; and others from the Point of beginning to freeze Water: I conceive theſe Points are not ſo juſtly determinable, but with a conſiderable Latitude: And that the juſt Beginning of the Scales of Heat and Cold ſhould not be from ſuch a Point as freezes any thing, but rather from Temperature, ſuch as is in Places deep under Ground, where the Heat of the Summer, or Cold in Winter, have (by the certain Experiment of the curious M. *Mariotte* in the *Grottoes*, under the *Obſervatory* at *Paris*) been found to have no Manner of Effect.

Hygroſcopes, by [illegible] *n. 127 p. 650. Fig. 8.*

XVI. 1. The *Hygroſcope* I make uſe of, I thus contrived. I took two pieces of Deal-board, (*Poplar* would have been better) each about two foot long and a foot or more in breadth, *AB*. Theſe I got well plained and ſhotten, that their edges might meet even together. Of theſe two, ſet edge by edge, I faſtned each End between two Ledges of Oak *CC*, of 2 Inches broad, and long enough to reach athwart both boards, (but one ledge, if it be thick enough might be made to ſerve each End, by making hollow furrows or gutters in it to receive the ends of the boards) and ſo I fixed both boards in, as pannels are ſet in Wainſcot. This done, ſuppoſing ¼ of an inch to be the utmoſt diſtance that theſe two boards would ſhrink aſunder in drieſt Weather, (for it mattered not much, though it ſhould be ſomewhat more or leſs) I took a thin piece of Braſs *D*, of two or three inches long and ½ inch broad, and upon one edge, towards the end, I meaſured ¼ of an inch: (which was the utmoſt diſtance I ſuppoſed the two boards would gape aſunder;) which ſpace *dd*, I divided into five equal parts, and with a ſmall File made them into ſo many fine teeth, like thoſe of a Watch wheel. This piece of Braſs I placed flat, acroſs the juncture of the two boards, nailing its one end by means of two ſmall holes *bb*, to the board *A* only, and leaving the other end, which is the toothed one, free and reaching to a competent diſtance over the Board *B*, to which it had no coherence. Next I made a pinion, (conſiſting of as many teeth as the Braſs had) *e*, upon the end of a piece of thick Iron Wire: This Axle *F*, with its pinion *e*, I ſo faſtned to the other Board *B*, by means of the Brachiolum *E*, and ſo adapted to the teeth of the Braſs plate, that when the boards do ſhrink aſunder, the Braſs being drawn a little away, muſt needs turn this Axle (by means of its toothed pinion) more or leſs; and ſo if ever it happens, that the boards gape but a quarter of an inch aſunder, this Axle will have made one intire revolution: Wherefore I put a long Index *GG*, upon the extremity of this Axle, and made a Circle round it with the uſual graduations, numbred from what point I pleaſed, and the Motion of the Index back or forward, ſhews me the degrees of the drought or moiſture of the Air. Now this Axle may be made to come through a round plate of Wood or Metal that hides the contrivance, all but the Hand and Figure, as in a Clook or Watch. 'Tis to be noted moreover, that the boards muſt be faſtned to the ledges, only at the outer edges, as at *aaaa*, that they may have the more liberty of ſwelling and ſhrinking aſunder. Though the *Hygroſcope* which I make uſe of be none of the beſt Workmanſhip, nor exactly made after the Deſcription I have here given you, (the boards having not liberty of gaping above $\frac{1}{10}$ of an inch) yet I have oftentimes the pleaſure of ſeeing the Index turn 10 or 20 degrees in an Hour or two, and when the Air is changed, will return as ſwiftly, by the ſhrinking and ſwelling of the Boards.

2. *AAAA*, is a Frame of Wood for two Pannels of Deal to play looſe in at top and bottom, to which at the two ends they are faſtned. *BB*, The two Pannels of ſlit Deal, three foot deep and three foot broad apiece, with a diſtance left in the middle for the ſcope of the Motion *C*. The Hand, placed or faſtned by the Axle-tree to the plate, and alſo with Nail holes which are to faſten it to the middle of the Pannel within half an inch of the ſcope for motion; at the lower or ſhorter end of which Axle-tree there is, by a Wire like an *S*, faſtned a ſmall Silver Chain within a ſtraw's breadth of the Axle-tree; which Chain is to be carried and placed croſs the diſtance between the two pannels and faſtned to the pannel oppoſite by a Braſs nooſe, through which it is to ſlip, ſo as that it may be taken up or let down at pleaſure. *D*, The Roller with a weight annexed, which by a ſtring is faſtned to the loweſt end of the hand *C*; ſo that as the Relax gives way, the Weight will adjuſt the Motion of the Hand to the Index *E*. *E*, the Index of Paper,

By Mr Co-
niers, n. 125.
p. 715
Fig. 8.

paſted upon the oppoſite pannel to the Hand, and ſo as it is in this Figure; placed near the top, for the better advantage of the Hand's Motion; and this Index, being but a quarter of a Circle, is divided into Inches more or fewer according to the Scope which the Pannels Hand requires for their Motion, but when the Relax ſhall require more room for the Hand then the Chain is to be taken up one Link more, and ſo you will be ready for more play upwards and downwards: Which taking up may yet be again repeated, when there is occaſion, or the time of Year requires it.

Now if the Chain be placed near the Axle-tree, the Motion will be the nicer and larger; if farther off, then it will be leſs: For Example, the Motion of 2 more than that of 3, and 3 than that of 4, *&c.* as you may perceive by the Figures 2, 3, 4, 5, 6; which are placed in this Figure by the lower end of the Hand near below the Axle-tree thereof.

From this Contrivance it was, That I have for this 5 or 6 Years paſt made theſe following Obſervations.

1. That theſe Pannels of Deal-wood will move by ſhrinking moſt in Summer, and ſwelling moſt in Winter Seaſons; but will vary from this, according to the Change to the then more or leſs Heat or Cold, Moiſture or Drought, that the temper or ſeaſon of the Year, ſuch as Spring and Fall, do produce; it being then more apt to ſwell or ſhrink on the ſudden, but not attaining then to the higheſt ſhrinking or ſwelling, as in Summer and Winter it doth.

2. That for the moſt part, eſpecially in the Spring and Summer time this Motion happens only in the Day time; for then generally all Night it reſts and moves very ſeldom.

3. That one kind or manner of this Motion happens in dry fair Weather, but ſometimes in the forepart of the Forenoon, and ſometimes not until the latter part of the Forenoon, and then at that time it relaxes or ſwells the Deal for about two or three Hours; more, ſeldom; leſs, often; and then all the Afternoon after ſhrinks; nay, ſome times even when a ſmall Rain hath newly fallen, or is then falling; and this not ſo often, but more ſeldom in Winter, or Cold moiſt Weather.

4. This Shrinking is gradual very often, or for the moſt part a little after a moiſt time (*viz.*) the firſt Day after Moiſture it ſhrinks a little, the ſecond Day more, and ſo yet more according to the then time of Year, and as it is then inclined to Moiſture or Drought, and alteration of the Wind and the then Heat or Cold.

5. The Winds being in the North, North Eaſt, and Eaſt, Winter and Summer, for the moſt part at that time the Deal ſhrinks in the Night alſo as well as in the Day; but not ſo much; Which is a ſign of drying Weather, and ſometimes of Froſt or Cold in Winter; Heat or Scorching in Summer, in a clear Day. But on the contrary, the South Winds blowing, or the Weſt and South-weſt, the Deal then always relaxes that Day, or at leaſt is at a Stay, provided this happen in the Day time; for then, if in the Night, not ſo much; and ſo this will do ſome conſiderable time before Rain.

6. By a conſtant Obſervation of this Experiment of the Deal's Motion and

Reſt, you may be able to know or gueſs at the Wind's Situation without a Weather-cock, provided you have by you a common and a ſeal'd Thermometer.

7. Alſo you may know the time of the Year; for in the Spring it moves quicker and more than in Winter; in Summer it is more ſhrunk than in the Spring; in Autumn leſs in motion than in the Summer.

I ſhall only add, that to find whether the Moiſture was rarified out of the ſmall Cylinder-like Ends of the Wood only, or out of the Sides alſo, I took two pieces of ſeaſon'd Deal; the Ends of the one piece I cloſed up with Diachylon Plaiſter. but the Sides of this Deal I did not ſo cloſe up; but left theſe ſides with the other piece without Diachylon. Both being expoſed to the open Air, they were found the next Day both of them alike to have increaſed in proportion of Weight, which ſeems to prove that the Sides alſo do take in and let out Moiſture.

In a ſecond Contrivance, *A A A A*, is the Frame of Wood, for the Pannels of Deal to play looſe in, at the top and bottom. *B B B B*, the Croſſes of Deal or Iron faſtned to the Frame on each ſide; to which is annexed the Circular Index divided into 12; in the Center of which the Axle-tree *b*, for the Hands, is placed. *C C*, the two Pannels of ſlit Deal, 3 foot deep, and 3 foot broad apiece, faſtned at each end of the Frame, with a diſtance left in the middle for the ſcope of the Motion. Fig. 10.

The inward Work is thus contrived. *A A*, the two Hands, *B B*, the two Braſs Pullies or Rollers, the one bigger, the other leſs; to the bigger a flat Leaden weight is faſtned with a Cat-gut ſtring; to the ſmaller is faſtned a ſmall Silver Chain, which is by the Nooſe or Loop of the Braſs *C*, to be faſtned to the Pannel under the middle of the Croſs, near the Gap or Scope for the Motion; and in that nooſe the Chain to have a faſtning to be taken up or let down at pleaſure. *D*, the Roller or Pully to be placed on the other Pannel oppoſite to the Nooſe, and near the Gap or Scope, betwixt the two Pannels; over which Roller the ſmall Chain, upon its return to the Axle-tree, is to be placed. *E*, the Axle tree, upon which the two Rollers or Pullies *B b*, are to be faſtned, and the two Hands *A A*, for the Index. *F*, the Weight annexed to the biggeſt Roller or Pully *B*, and the ſtring or Cat-gut to be moved, is to have the contrary poſture for motion to the ſmall Roller or Pully upon which the Silver Chain is faſtned: So that as the Shrinking of the Pannel moves the Axle-tree one way, the Relaxing may give to the moving the Hands or Axle-tree the other way by the Power of the weights drawing; which contrary poſtures will give the niceſt account of this Motion. Fig. 11.

The Circumference of the ſmalleſt Pully or Roller *b*, is to be no bigger than juſt ſo much ſcope or diſtance as the two Pannels make by the extremity of their utmoſt ſwelling or ſhrinking; and ſo one full Revolution of the Hand upon the Index may anſwer the fulleſt ſhrinking and ſwelling in the Year, and the diſtance between the two Rollers or Pullies, fixt upon the Axle-tree, muſt be the thickneſs of your Pannels; ſo that the Weight is to play or move on the one ſide of the Pannel, and the Chain on the other, without diſturbance or rubbing againſt the ſides of the Pannel or the Croſs, between which, out of ſight, in the middle they are to be placed.

This way was ſo contrived 1675, ſome Years after the former; and ſo with Chain and Pullies to avoid the ſhaking that would happen by applying the Work of Pinion and Teeth to move the Hands; which was then alſo propounded to Mr. *Tompion* the Watch-maker, but by him rejected, though I think that way may be uſed alſo with a Weight added to regulate the Motion.

The Deal-board ſhould be of the fineſt ſtreighteſt grain'd *Dram-deal*, laid a drying in your Houſe two or three Years.

By Mr. Molyneux, n. 172. p. 1032. *Fig.* 12.

3. *A B*, is a Whipcord about four foot long, tied faſt to the end of the Hook *A*. At the end of this Whipcord there hangs the Weight *C*, about a Pound or ſomething more; this Weight is ſo fitted at the end as to receive and carry the Index *D*. Under theſe there is placed a Graduated Circle on the Board *E F*, Fixt by a Bragget againſt the Wall.

All things being thus adapted, the Moiſture of the Air twiſts the Rope, and gives a motion to the Index over the Diviſions in the Graduated Circle; and again as the Air grows more Dry, the Cord untwiſts and brings back the Index by a contrary Motion. The Reaſon of this is plain; for the little particles of the Moiſture inſinuating and ſoaking into the Cord are like ſo many Wedges, which muſt needs ſhorten the Rope, as a Bladder is ſhortned by being blown up and will lift a great weight, but the eaſieſt way for the Rope *A B*, to ſhorten and lift up the Weight *C*, is to do it by way of a Screw; for it ſelf is a Screw, the ſtrands thereof being twiſted (and each particular thread in it) Screw-wiſe, and conſequently muſt give a Circular Motion to the Index.

To make an Experiment of this, I wetted a Cord and hung it up with the Weight at the end of it, and I perceived as it dryed it untwiſted, and that too very quick, ſo as to be perceived by the Eye; after the Cord had ſo far untwiſted, as I thought it had come to that degree of dryneſs, that the preſent Conſtitution of the Air would permit, I took a Baſon of warm Water, that ſent out a Steam and Fume, and placed it under the Cord; immediately the Cord began again to twiſt very quick, and ſo continued till the Water ceaſed Fuming, or was removed, and then immediately it began to return its twiſts. I then tried to breath upon it gently with my breath, and found according to my expectation, that 8 or 10 breathings would twiſt it 5 degrees of a Circle. I then permitted it to the Air only, and I find it to obey the Alterations thereof moſt nicely; there falls not the leaſt ſhower, at which it does not preſently twiſt; and when by Riſing Clouds a fair Day becomes over-ſhadowed, the Cord is immediately ſenſible thereof, and again as ſenſible of their vaniſhing and Alteration to fair Sun-ſhine. So that I repute it to be the niceſt *Hygrometer* that has ever yet been uſed, and I am ſure is as cheap and plain as any.

One of the grand defects of moſt (indeed I think of all) *Hygrometers* hitherto invented, is that they grow weak with age, and do not ſo nicely obey the Alterations of the Air, when long kept as when firſt made; but whether our preſent invention be ſubject to the ſame fault I leave to time to determine

The Alterations alſo of the Air may give this kind of *Hygroſcopes* more than one Turn; now this being inconvenient, and the Duplication of the Turn hard to be regiſtred as Mr. *Hook* propoſes, in his *Micrography*, concerning the Beard of a Wild-Oat; I have thought of a way for remedying this, for it being in our Power to increaſe the Diameter of our graduated Circle as large as we pleaſe, what need have we of more than one Turn, from the greateſt degree of Moiſture to the greateſt degree of Drought? Now ſuppoſe I find this *Hygroſcope* to have two compleat Revolutions (this is to be found by Obſervation throughout a whole Year,) I ſay then the way of rectifying it is thus. The Index *D*, has two compleat Turns, the point *A*, as being fix'd, has no Turn or Motion, therefore the middle point *G*, has but one Turn, and conſequently if I hang it up at the point *G*, or no longer than *G D*, half the former length, the Index *D*, will have but one Turn. What is here ſaid of two Turns and the middle point *G*, may be accommodated to any other Number of Turns and parts, and points in the Rope.

If a Candle, or Heated Iron, be applyed nigh the Rope, it makes it Twiſt very quick, contrary to Mr. *Hook*'s Oat-beard.

We may in this Experiment perceive ſomething that may help us in the conſideration of the ſtrength and motion of the Muſcles of Animals; for take a Cord able to ſuſtain an hundred pound Weight, by the Weak Fume or Steam of Warm Water this weight ſhall be lifted up; for if this Steam turn the Weight (as moſt certainly it will do, if the Rope be of any moderate length) the Weight is as certainly lifted up thereby as by a Screw, as is evident to any one that conſiders it. If therefore ſuch mighty performances can be produced by the Application of ſuch mean agents, as we all know and are converſant with, what ſhall we think is too great for thoſe Parts which God has contrived and framed in the Bodies of Animals.

4. It is Obſerved, that when *Oil* of *Vitriol* is ſatiated in the moiſteſt Weather, it afterwards retains or loſes its acquired Weight as the Air proves more or leſs Moiſt. Thus one Grain after its full Encreaſe often vary'd its *Æquilibrium* ſo ſenſibly, that the Tongue of the Balance of 1½ inch long deſcribed an Arch of Variation to ⅓ of an inch compaſs, (which Arch would have been 2⅔ inches, had the Tongue been but one Foot in Length) even with that little Quantity of Liquor; ſo that if more Liquor expanded under a large Surface be uſed, the minuteſt Alteration of Weather muſt needs very much more affect it, and a bare pair of Scales will afford an *Hygroſcope* as nice perhaps as any yet known. *By Mr. Will. Gould, n. 156. p. 504.* Vid. inf. Cap. III.

This Balance may be contrived two Ways, either ſuch whoſe Pin ſhould be in the middle of the Beam, with a very ſlender tapering Tongue, of a Foot or one Foot and an half long, pointing to the Diviſions on a broad Arched Plate, fix'd above in the Handle; or elſe the Scale with the Liquor may be hung to a point of the Beam very near the Pin, and the other extream made ſo long as to mark a large Arch on a board plac'd conveniently for that purpoſe. The Scale in either may be a Concave Glaſs of 4 or 5 inches Diameter. Laſtly on the Diviſion of the Arches ſhould be inſcrib'd the different Temperature of the Air ſhewn by the Liquor. *Fig.* 13. *Fig.* 14.

I have Reaſon to think that *Oyl* of *Sulphur per Campanam*, as alſo *Oyl* of *Tartar per Deliquium*, and the Liquor of *Fixt Nitre*, &c, may ſucceed as well.

Another; by Mr. W. Gould, ib. p. 503. *Fig.* 15.

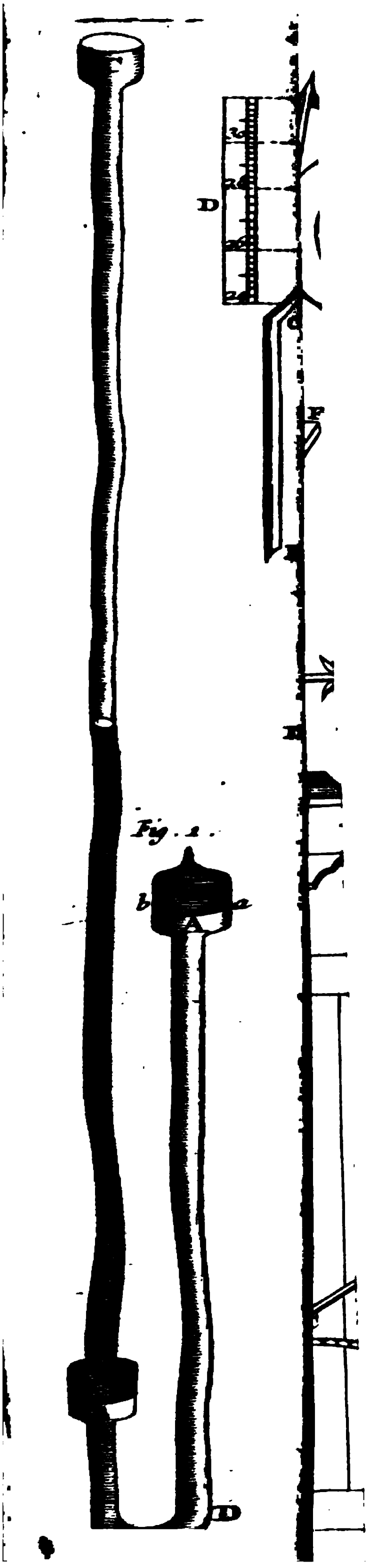
5. Another *Hygroſcope* may be made of a Viol-ſtring running upon Pullies, and ſuſpending a Bullet fixt to the ſhorter End of an Index, whoſe other Extremity is ſo long as to deſcribe a long Arch by the falling and riſing of the Bullet upon the ſtretching and ſhrinking of the String, which would be more nice were the Index faſtned to the Center of the laſt Pully.

To obſerve the Strength of Winds; by .... n. 24. p. 444. *Fig.* 16.

XVII. Expoſe the Inſtrument *A B C D*, to the Wind, ſo as the flat Side *CD*, may be right againſt it; the number of Degrees upon the Limb *A B*, to which the Wind blows up, or raiſes that flat Side, ſhews the Force or Strength of the wind, in Proportion to the Reſiſtance of the flat Side of the Inſtrument.

Remarks concerning the Gradual Alteration of the Temperature of the Air in America *and in* Ireland; *by* .... n. 127. p. 648.

XVIII. That in *America* (at leaſt as far as the *Engliſh* Plantations are extended) there is an extraordinary Alteration as to Temperature, ſince the *Europeans* began to plant there firſt, is the joint Aſſertion of them all. This Change of Temperature is, and not without ſome Reaſon, generally attributed to the cutting down of vaſt Woods, together with the clearing and cultivating of the Country. But that *Ireland* ſhould alſo conſiderably alter, without any ſuch manifeſt Cauſe, doth very much invalidate that Reaſon. For if it be true, as ſome compute, that this Kingdom was better inhabited and husbanded before the late bloody War, than at preſent, it ſhould, according to the Reaſons alledged for the Change of Temperature in *America*, be rather grown more intemperate, *viz.* for want of Cultivation: But the contrary is obſervable here, and every one almoſt begins to take notice, that this Country becomes every Year more and more temperate. Now whether there were more Inhabitants in *Ireland* before the late War than at preſent, I ſhall not here inſiſt upon, neither do I think it an eaſy Matter to determine; yet ſure I am, that there has been no ſuch Increaſe of People here within theſe 16 or 20 Years, nor ſuch Improvements as to be unaccountable for the great Change of Temperature that is of late obſerved. Within leſs than the Time newly mentioned, 'twas not unuſual to have Froſt and deep Snows of a Fortnight and three Weeks Continuance; and that twice or thrice, ſometimes oftner in a Winter; nay, we have had great Rivers and Lakes frozen all over; whereas of late eſpecially theſe 2 or 3 Years laſt paſt, we have had ſcarce any Froſt or Snow at all. Neither can I impute this extraordinary Alteration to any fortuitous Concourſe of ordinary Circumſtances, requiſite to the Production of fair Weather, becauſe it is manifeſt, that it hath proceded gradually, every Year becoming more temperate than the Year preceeding. And I obſerved particularly, that all the winter $167\frac{4}{5}$ was very mild, and warmer than could be well expected from ſuch a Seaſon, and but very little Rain. Having in the whole Month of *February* not rained above twice or thrice (at leaſt in that part of the Country where I then was) inſomuch that many took upon them to predict, that ſuch unſeaſonable Weather would certainly be the Cauſe of ſome Dearth or Peſtilence the enſuing Summer, or Autumn; but their Predictions proved as falſe as the following Harveſt was extraordinary both for Health and Plenty.



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Obſervations of the Weather in Ireland, 1675. *ib.* p. 649.

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To Meaſure the Quantity of falling Rain; by Mr. Townley, n. 208. p. 51.

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Another; by Mr. W. Gould, ib. p. 505. Fig. 15.

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To obſerve the Strength of Winds; by .... n. 24. p. 444. *Fig. 16.*

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Obſervations of the Weather in Ireland, 1675. ib. p. 649.

This Winter 167$\frac{5}{6}$ now newly ended, I have kept an exact Account of Wind and Weather, being well provided with a *Barometer*, Sealed *Thermometers*, *Hygroſcopes*, &c. To tranſcribe my Journal here would be too tedious; Let it ſuffice therefore to tell you, that it hath been a very Fair and Warm, or rather no Winter at all; that we have not had above 5 or 6 Froſty Mornings this winter, and none that laſted longer than till Noon; that we had Snow but thrice, the firſt before *Chriſtmas*, the ſecond upon the 11*th*, and the third upon the 17*th.* of *January*: This laſt, which was the longeſt Snow we had this winter, continued not 48 Hours, but Thawed. All this winter we never had 2 Days of Rain together, nor above 2 or 3; that could be well called Rainy Days. *Mar.* 14. we had a ſhower of Rain and Hail together; the wind being South-weſt and Calm. The Mercury in my *Barometer* (which is very ſlender, but carefully fill'd, and conveniently placed) is for the moſt part about 29$\frac{4}{10}$ Inches high, above the Surface of the Stagnant Quick-ſilver; but yet doth very ſenſibly and frequently vary its height, according to the difference of the Atmoſphere's Gravity: *Jan.* 17. (which was the Day it laſt Snowed here) the Mercury was ſubſided to 28$\frac{9}{10}$ Inches. The next Day it was 28$\frac{6}{10}$, being towards Night ſomewhat bluſtering, and the Snow Thawed. *Jan.* 19 being Fair but very Foggy, the Mercury was at 28$\frac{1}{2}$, which is the loweſt Station it was ever at yet with me; the wind was weſterly and Calm. The next Day it was up again to 29, and afterwards higher. *Feb.* 15. in the Morning, being Cloudy, the wind weſterly and bluſtering, the Mercury was at 29$\frac{8}{10}$; and about a 11 that Night, being Fair, Clear, and Calm, it was riſen to 30$\frac{2}{10}$ inches. The the next Day being ſtill Fair, Calm, it was at 30$\frac{3}{10}$ inches; which is the utmoſt Height I have yet ſeen it at. Next Day it fell a little beneath 30, and kept, as before, for the moſt part about 29$\frac{3}{10}$ or $\frac{4}{10}$, to this preſent; only on the 11*th* of *March* it was at 30 again. Though it be obſerved, that Froſty and Snowy winters make early Springs, and for as little as we have had of either this winter, yet there hath not within the Memory of any now living happened a forwarder Spring in *Ireland*; ſince this Place could produce ſome ſtore of Ripe *Cherries* in the midſt of *April*. The wind keeps for the moſt part here between the North-weſt and the South, ſeldom at Eaſt, and yet ſeldomer at North or North-eaſt, in ſo much that many here don't ſcruple to affirm, that for at leaſt $\frac{3}{4}$ of the Year the wind is weſterly; and we have ſometimes known Paſſengers wait at *Cheſter* and *Holy-head* no leſs than 3 Months for a fair wind, to come hither.

To Meaſure the Quantity of falling Rain; by Mr. Townley, n. 208. p. 51.

XIX. I fixed a Round Tunnel of 12 inches Diameter to a Leaden Pipe, which could admit of no Water, but what came through the Tunnel, by reaſon of a part ſoder'd to the Tunnel it ſelf, which went over the Pipe, and ſerved alſo to fix it to it, as well as to keep out any wet that in ſtormy weather might beat againſt the under part of the Tunnel; which was ſo placed that there was no building near it that would give occaſion to ſuſpect that it did not receive its due proportion of Rain that fell through the Pipe ſome nine Yards perpendicularly, and then was bent into a Window near my Chamber, under which convenient Veſſels were placed to receive what fell into the Tunnel; which I meaſured by a Cylindrical Glaſs, at a certain mark containing juſt a Pound or 12 Ounces *Troy*, and had marks for ſmaller parts alſo. By the Help of this Cylindrical Glaſs I thus kept my account of what Rain fell, and generally twice or thrice a Day; when I took ſeveral other Obſervations, both of the *Thermometer*, *Barometer*, Winds, *&c.* what Rain I found in the Receivers, if not more than made what was left in the Cylindrical Glaſs a full Pound, I again left in it; but if there was more than that quantity, I filled it juſt to the Pound Mark, which I threw away, and did the like with the remaining Water as often as it would allow, ſtill keeping an account chiefly of the Pounds thrown away, and noting alſo the parts of a Pound remaining in the Glaſs; by the help of which latter, and the parts remaining at any time before, by numbering the Pounds and ſubſtracting the parts at the end, (for example, of one Month,) from the Pounds thrown away, and the parts remaining at the end of another, I find the Quantity of Rain faln betwixt theſe two times, and that ſo as to aſſure me that I erred no more in the quantity of Rain of another Year, than by the miſtake in the differences of the parts of a Pound in the firſt and laſt Obſervation: whereas ſhould I ſtill write down the Rain that falls between two Obſervations, I might be ſubject to make as great a miſtake in every one of them, and conſequently be much more uncertain of the Quantity of Rain faln in many of thoſe added together: Beſides, this Addition is longer in performing and giving the Quantity ſought, than the Method I make uſe of. I have added theſe particulars to ſhew you how little trouble there is in this Task.

Obſervations of the Rain, falling Monthly for 15 Years; by Mr Townley. *ib. p.* 53.

	1677	78	79	80	81	82	83	84	85	86	*Sum.*
Jan.	472	371	43	512	53	986	238	32	110	472	3289
Feb.	270	371	161	492	363	135	245	483	42	20	2582
March.	245	250	202	413	235	237	305	87	185	572	2731
April.	325	170	92	222	57	308	402	370	380	305	2631
May.	313	581	105	188	69	315	353	97	201	437	2659
June.	516	257	298	342	397	517	468	192	410	473	3870
July.	351	339	350	302	292	482	412	313	497	188	3526
Aug.	485	145	835	502	425	385	582	338	398	870	4965
Septemb.	223	527	553	146	607	293	152	199	163	572	3435
October.	333	644	616	570	170	427	330	425	325	293	4133
Novem.	432	555	127	479	235	525	192	579	522	709	4355
Decemb.	400	57	439	269	423	456	37	299	548	132	3051
Sum.	4365	4267	3821	4428	3326	5066	3716	3414	3781	5043	41227

1689 *Jan.*

	1689	90	91	92	93	*Sum.*
Jan.	333	707	197	54	218	1509
Febr.	393	171	112	168	78	922
March.	875	145	476	342	298	2136
April	468	78	386	498	539	1969
May.	182	244	300	330	93	1149
June.	302	179	412	416	181	1490
July.	120	218	285	448	112	1183
Auguſt.	222	402	193	198	668	1683
Septem.	442	403	215	605	641	2306
Octob.	740	765	165	273	514	2457
Novem.	415	717	230	148	627	2137
Dec.	368	262	169	892	261	1952
Sum.	4860	4291	3140	4372	4230	20893

All I have yet learnt from theſe Obſervations, as to the main point, is, that here we have almoſt juſt twice the Quantity of Rain that falls at *Paris.* This County, (of *Lancaſter*) and particularly that part of it (about *Townley*) where I live, being generally eſteemed to have much more Rain than other Parts, and in a greater proportion than I thought reaſonable to be allowed; however it be, yet by what I have ſent you, 'twould be unjuſt, without farther Obſervations of the like nature in other parts, that all *England* ſhould be eſteemed to abound as much in Rain as theſe parts do, where, by reaſon of the very high Grounds in *Yorkſhire*, and the Eaſtern Parts of *Lancaſhire*, the Clouds driven hither by the *S.* and *S. W.* the general Winds in this part of the World, are oftner ſtopt and broken, and fall upon us, than ſuch as come by an *E.* or *S. E.* wind, which broken by the Hills, are generally ſpent there, and then little affect us; and this is the Reaſon that *Lancaſhire* has often conſiderably more Rain than *Yorkſhire*.

In the Table I have ſent you the Pounds and Parts are doubled, and theſe I have rather ſent you than thoſe of the whole Pounds; ſince the ſame gives both the Quantity of half Pounds, and the Height in Inches, according to the general way of eſtimating the quantity of Rain, only with this difference, that for the half Pounds, only the laſt Figure is a Decimal Fraction, and the other the number of the half Pounds; and for the height, the 2 laſt Figures denote the decimal Fraction of an Inch, and the remainder the height in inches, ſo near the truth, that they only fall ſhort of it 1 inch in 200, which defect is eaſily ſupplied. To this I need only add, that the Numbers on the right hand are the Sums of all thoſe in the ſame Line, that is in the firſt part of ſeveral numbers for 10 Years; ſo that the laſt of them ſhews the Sum, both of the half pounds that have fallen during that Space of Time, and the height the Water would have been raiſed in that time alſo. To this I ſhall only add one Example: The Sum of all the Rain in the 10 firſt Years is 41227, and therefore according to what hath been ſaid, 4122,7 is the number of half pounds that fell in the Compaſs of the Tunnel during thoſe 10 Years; and 412,27 the Height it would have raiſed the Water during that Time. But if you deſire to be more critical, if you add 2 06 its 200*th* part, you will have 414,33 for the true Height, and 41,433 for the mean Height, by thoſe ten Years Obſervations; and 412,27 for the mean Quantity of half Pounds. By the ſame Method you will have the Means for the other five, *viz.* of Height 41,78; and 417,8 for the mean number of half Pounds, which Means do ſtrangely agree, and both conſidered, do give for the Mean by all the 15 Years 41,516 Inches in Height, which is about $\frac{1}{2}$ of an Inch more than double to that raiſed by the Water at *Paris*, which is ſet down in the *Memoirs for the Ingenious*, for *February* laſt, is ſtated about 19$\frac{1}{2}$ *French* Inches, which make 21 *Engliſh*.

My way of Gauging by Weight is grounded upon 22,7368 Cubical Inches of Rain water being equal in weight to one Pound, or 12 Ounces *Troy*; ſo that dividing any Superficies in Inches of a Veſſel, for receiving the Rain-water, by the before mentioned Number, it will give you the Pounds and Parts that will raiſe the Water upon that Superficies, with upright Sides, juſt an Inch: And thus I found that 4, 974 Pounds would fill a Cylinder equal at the Bottom to my Tunnel and one Inch high, which you ſee is very near 5 Pound, which you will alſo find will only raiſe the Cylinder higher by $\frac{1}{200}$ part.

A Hiſtory of the Weather at Oxford, 1684; *by* *Dr.* Plot, n. 169, p. 930. Fig. 17.

XX. I here give you the Obſervations of a full Year, made by Order of the *Philoſophical Society* at *Oxford*, not only of the Riſe and Fall of the Quick-ſilver, (mark'd by the wandring prickt Line, after Dr. *Liſter*'s Method) and the Weather; but alſo how the Wind ſtood each Day. If the ſame Obſervations were made in many Foreign and Remote Parts at the ſame Time, we ſhould be enabled with ſome Grounds to examine, not only the Coaſtings, Breadth and Bounds of the Winds themſelves, but of the Weather they bring with them; and probably in Time thereby learn to be forewarned certainly of divers Emergencies (ſuch as Heats, Colds, Dearths, Plagues, and other Epidemical Diſtempers) which are now unaccountable to us; and by their Cauſes be inſtructed for Prevention, or Remedies. Thence too in Time we may hope to be informed how far the Poſitions of the Planets, in Relation to one another, and to the fix'd Stars, are concerned in the Alterations of the Weather, and in bringing and preventing Diſeaſes, or other Calamities; for by this means it is, doubtleſs, that the Learned Dr. *Goad* of *London*, has arriv'd to that pitch of Knowledge, he already has, in predicting Weather. This, no Queſtion, was the Opinion of the induſtrious *Walter Merle*, Fellow of *Merton College*, who thus obſerved the Weather here at *Oxford* every Day of the Month 7 Years together, *viz.* from *Jan.* 1337, to *Jan.* 1344: the MS. Copy of which Obſervations are yet remaining in the *Bodleyan* Library. And doubtleſs it was ſome ſuch Conſideration as this, that moved *Eraſmus Bartholin* to make Obſervations of the Weather every Day through the whole Year 1671, which are printed *inter Acta Medica Tho. Bartholini.*

Weather,

D.	*Weather*, Jan. 168¾.
1	Hard Froſt, and Fair.
2	Froſty, but yielding a little towards Night.
3	Rimy Froſt.
4	Hard Froſt and fair.
5	Hard Froſt, and fair.
6	Hard Froſt, and fair.
7	Hard Froſt, but a little yielding at Night.
8	Rimy Froſt morn. Fair all Day, windy Night.
9	Froſt, but Snow at Night.
10	Cold raw weather toward Noon, Rain toward Night.
11	Moiſt thawing weather:
12	Cloſe thawing weather.
13	Moiſt, cloſe weather, a ſmall Froſt at Night.
14	Cloſe Froſty weather.
15	Cloſe Froſty weather.
16	Cloſe Froſty weather, at Night windy.
17	Froſt, at Night Snow.
18	Snow, and wind.
19	Cloſe ſharp weather.
20	Cloſe *ut ſupra*, but a little yielding at Night.
21	Mild Froſt, and fair.
22	Hard Froſt, Snow at Night a little.
23	Hard Froſt.
24	Hard Froſt, and fair.
25	Hard Froſt and Snow.
26	Froſt, a little Snow.
27	Froſt, a little Thaw about Noon.
28	Froſt, and fair.
29	Froſt, a ſmall Thaw all the Afternoon.
30	Hard Froſt, and fair.
31	Froſt, and fair.

D.	*Winds.*	*Weather*, Feb. 168¾.
1	*N. E.*	Froſt, and fair.
2	*N. E.*	Froſt, a little Thaw at Night.
3	Due *E.*	Froſt, and fair.
4	Due *S.*	Cloſe weather, and a little Thaw and Snow at Night.
5	*S. W.*	Thawing weather, wind and Rain at Night.
6	Due *W.*	Fair clear weather.
7	Due *W.*	Cloſe thawing, rainy weather.
8	*N.* by *W.*	Cloſe weather.
9	Due *S.*	Fair in the Morn, Rain and Snow at Night.
10	Due *S.*	Cloſe wet weather.
11	Due *S.*	Fair Morning, wet at Night, and windy.
12	*S. S. W.*	Cloſe Morning, fair at Night.
13	*N.* by *W.*	Cloſe morn. fair at night.
14	*W.* and *N.*	Rainy M. fair at Night.
15	N. *W.*	Fair weather.
16	Due *S.*	Rainy Morning, cloſe at Night.
17	*S. W.*	Cloſe moiſt weather.
18	*S. W.*	Rainy and wind.
19	Due *W.*	Moiſt morning, fair afternoon.
20	*W. S. W.*	Open fair weather.
21	*S. W.*	Cloſe weather, windy.
22	*W. S. W.*	Cloſe rainy weather.
23	Due *W.*	Wet Morn. fair After-n
24	*W.* by *S.*	Fair Morning, cloſe Evening.
25	*S. W.*	Fair Morning, cloſe Evening.
26	*S. W.*	Wet Morning, cloſe Evening.
27	*S. E.*	Wet M. fair Evening.
28	*N. E.*	Cloſe froſty weather.
29	*E.* by *S.*	Froſty clear weather.

Winds

D	*Wind.*	*Weather.* March 168¾.	D	*Wind.*	*Weather.* April 1684.
1	*S. E.*	Cloſe Froſty Cold weather.	1	*N. & W.*	Fair ſun-ſhine weather.
2	*N. E.*	Cloſe Cold weather.	2	*W. b. N.*	Rain in the morning, fair evening.
3	*N. b. W.*	Cloſe Froſty weather.	3	*S. b. W.*	Fair morning, wind and rain at night.
4	*N. b. W.*	Cloſe Cold weather.	4	*S. b. W.*	Cloſe moiſt weather.
5	Due *N.*	Cloſe Morning, Snow Evening.	5	*S. W.*	Rainy weather.
6	*N. E.*	Cloſe Cold weather.	6	Due *W.*	Fair morning, wet at night.
7	*N. N. E.*	Froſt, Fair and windy.	7	Due *W.*	Fair weather.
8	*N. N. E.*	Froſt, Cloſe and windy.	8	*S. W.*	Cloſe weather.
9	*E. b. N.*	Froſt, and high winds.	9	*N. W. & N*	Cloſe weather, but fair.
10	*E. N. E.*	Cloſe froſty cold weather.	10	*N. E.*	Cloſe fair weather.
11	*N. b. W.*	Froſt and fair, cloſe at night.	11	Due *E.*	Rain and wind moderate.
12	Due *N.*	Froſty, ſnowy, windy weather.	12	*N. & W.*	Cloſe cold weather.
13	*N. b. E.*	Froſt morning, fair night	13	*N. b. E.*	Fair ſun-ſhine weather.
14	*N. b. E.*	Froſt, ſnow, and wind.	14	*E. N. E.*	Fair morning, cloſe evening.
15	*N. N. E.*	Snow and wind.	15	*N. E. b E.*	Cloſe cold weather.
16	*N. N. E.*	Snow and rain.	16	*E. b. N.*	Cloſe cold weather.
17	*N. b. E.*	Cloſe moiſt weather.	17	*E. b. N.*	Cloſe cold weather.
18	*W. b. N.*	Cloſe morning, fair night	18	*S. & W.*	Variable dry weather.
19	*N. E.*	Cold changeable weather.	19	Due *S.*	Moiſt morning, wet night.
20	*N. N. W.*	Snow, and cold high winds.	20	*S. E. & S. W.*	Cloſe warm weather.
21	*N. E.*	Cloſe, but fair weather.	21	*S. E.*	Fair ſun-ſhine weather.
22	*N. E.*	Fair weather, but cold.	22	*S. & N. & E.*	Fair morning, inclinable to rain at night.
23	*E. b. N.*	Cold fair weather.	23	*S. W.*	Rainy morning, fair evening.
24	*E. b. N.*	Cold fair weather.	24	*S. W.*	Fair ſun-ſhine weather.
25	*E. b. N.*	Cold fair weather.	25	*S. W.*	Fair ſun-ſhine weather.
26	Due *E.*	Cold fair weather.	26	Due *S.*	Cloſe dry weather.
27	Due *E.*	Cold cloſe weather.	27	*S. W.*	Fair ſun-ſhine weather.
28	*S. b. W.*	Warm moiſt weather.	28	*S. W.*	Cloſe dry weather.
29	*S. b. W.*	Wind and rain.	29	*S. W.*	Cloſe dry weather.
30	*S. b. W.*	Cloſe fair weather.	30	Due *S.*	Rain morning, fair evening.
31	Due *S.*	Fair calm weather.			

Wind.

D.	*Wind.*	*Weather*, May, 1684.
1	*S. S. W.*	Variable weather.
2	Due *W.*	Fair weather
3	*S. S. W.*	Cloſe fair weather.
4	*W. S. W.*	Cloſe fair weather.
5	*W. S. W.*	Moiſt Morning, fair Evening.
6	*W. S W.*	Cloſe fair weather.
7	*W. S. W.*	Cloſe Morning, Rain at Night.
8	*S.S.E.&S.W.*	Fair warm Weather.
9	*N W.*	Cloſe fair weather.
10	Due *W.*	Cloſe fair weather.
11	Due *W.*	Cloſe fair weather.
12	Due *W.*	Miſty Morning, fair Evening.
13	*S & W.*	Wet Morning, fair Evening.
14	*S. W.*	Cloſe weather ſome Rain.
15	Due *N.*	Cloſe fair weather, ſome Wind.
16	*N. N. E.*	Windy Morning, cloſe Evening.
17	*N. E.*	Cloſe dry weather.
18	*N. E.*	Cloſe fair weather.
19	*N. E.*	Fair Sun-ſhine weather.
20	*E.* by *N.*	Cloſe fair weather, ſome Wind.
21	*N. E.*	Warm Morning, cloſe Evening.
22	*N. E.*	Cloſe, fair and windy.
23	*N. E.*	Cloſe, fair and windy.
24	*N. E.*	Cloſe Morning, fair Sunſhine Evening.
25	*N. E.*	Cloſe fair weather.
26	*S. E.*	Fair Sun-ſhine weather.
27	*N. E.*	Cloſe fair weather.
28	*E.* by *N.*	Fair Sun-ſhine Weather.
29	*S. W.*	Wind and Rain.
30	Due *W.*	Cloſe fair weather.
31	*S. W.*	Cloſe weather, a little rain at Night.

D.	*Wind.*	*Weather*, June 1684.
	S. W.	Cloſe Morning, fair Evening.
2	Due *W.*	Cloſe Morning, rainy Evening.
3	Due *W.*	Fair Morning, Rainy Evening.
4	Due *W.*	Cloſe fair weather.
5	Due *W.*	Cloſe fair weather.
6	Due *W.*	Cloſe fair weather.
7	*W. & N.*	Cloſe fair weather.
8	Due *N.*	Fair Sun-ſhine weather.
9	Due *N.*	Cloſe fair weather.
10	*N. E.*	Fair Sun-ſhine weather.
11	Due *E.*	Fair Sun-ſhine weather.
12	Due *E.*	Fair Sun-ſhine weather.
13	*E. S. E.*	Fair Sun-ſhine weather.
14	*E. S. E.*	Fair Sun-ſhine weather.
15	*E. S. E.*	Fair Sun-ſhine dry weather.
16	*E. S. E.*	Fair Sun-ſhine hot weather.
17	*E. S. E.*	Fair Sun-ſhine hot weather.
18	*E. by N.*	Sun-ſhine Morning, cloudy Evening.
19	*E b.N.S.S.W.*	Sun ſhine hot weather.
20	*S. by W.*	A little Rain, cloudy.
21	*S. E. E.S. E.*	Lowring ſome Rain.
22	*N. E.*	Fair hot weather.
23	*N. E.*	Hot, a muddy Sky.
24	*N E.*	Sun-ſhine, clear.
25	*N. E.*	Sun-ſhine, fair weather.
26	*N. E.*	Sun-ſhine, dry weather.
27	*N. E. E.*	Very dry.
28	*E. S. E.*	Hot lowring Evening.
29	*S. S. W.*	Sun-ſhine clear.
30	*S. W.*	Cloudy, cool.

D.	Wind.	*Weather*, July, 1684.
1	*S. w. w. n. w*	Somewhat cloudy.
2	*W.*	A little Rain, fair.
3	*S. W.*	Fair, but cloudy.
4	*S. W. W.*	Cloſe, ſome Rain.
5	*S. W.*	Sun-ſhine Morn. gloomy Evening.
6	*S. W.*	Cloſe.
7	*W. S. W.*	Cool, cloſe.
8	*S. W.*	Hazy, ſome Rain.
9	*W. N. W.*	Some Rain, clear.
10	*N: W.*	Clear ſun-ſhine.
11	*S. W.*	Rain.
12	*W.*	Some Rain, fair Even.
13	*W.*	A ſhower or two.
14	*W. S. W.*	Cool cloſe weather.
15	*W. S. W.*	Rain.
16	*W.*	Cool cloſe weather.
17	*W.*	Cool cloſe weather.
18	*N. W.*	Fair ſun-ſhine weather.
19	*W. S. W.*	Lowring cool weather.
20	*W. N. W.*	Fair ſun-ſhine weather.
21	*W.*	Fair ſun-ſhine weather.
22	*W.*	Hot ſun-ſhine weather.
23	*W. S.*	Hot ſun-ſhine weather.
24	*S. E.*	Hot ſun-ſhine weather.
25	*E. b. S.*	Hot ſun-ſhine weather.
26	*E. b. S.*	Hot, a little Rain to'ards Night.
27	*W. N.*	Hot ſun-ſhine weather.
28	*W.*	Hot, Thunder, Rain.
29	*N. N. E.*	Cloudy, ſome Rain.
30	*N. N. E.*	Fair ſun-ſhine weather.
31	*N. E.*	Hot ſun-ſhine weather.

D.	Wind.	*Weather*, Auguſt 1684.
1	*N.*	Warm ſun-ſhine weath.
2	*W.*	Cool fair weather.
3	*S. W.*	Warm fair weather.
4	Due *S.*	Hot ſun-ſhine weather.
5	*S. W. b. S.*	Hot ſun-ſhine weather.
6	*S. W. b. S.*	Warm ſun-ſhine weather.
7	Due *S.*	Rainy Morning, fair Evening.
8	Due *S.*	Cloſe fair weather.
9	Due *W.*	Fair ſun-ſhine weather.
10	Due *N.*	Fair ſun-ſhine weather.
11	*S. W.*	Fair Morn. inclinable to Rain at Night.
12	Due *W.*	Rainy Morning. The ſame in the Evening.
13	Due *W.*	Fair ſun ſhine weather.
14	Due *W.*	Fair ſun-ſhine weather.
15	*W.*	Fair ſun-ſhine weather.
16	*W.* N.	A ſhower, ſun-ſhine weather.
17	*N. W.*	Sun-ſhine morning, cloudy Evening.
18	*N. N. W. N.*	A muddy sky in the Morning, ſun-ſhine Evening.
19	*N. S. W.*	Fair ſun-ſhine weather.
20	*S. S. W.*	Hot ſun-ſhine weather.
21	*S. S. W.*	Hot ſun-ſhine weather.
22	*S. W.*	Fair ſun-ſhine weather.
23	*S. W.*	Hot ſun-ſhine weather.
24	*S. W.*	Hot ſun-ſhine weather.
25	*N.*	Rain all Day.
26	*S. W.*	Rain at Night.
27	*N. W.*	Cloſe, ſome Rain.
28	*S. W.*	Cloſe weather.
29	*S. S. W.*	Cloſe, Rain at Night.
30	Due *S.*	Variable Weather.
31	*S.* by *E.*	Cloſe, ſome Rain.

D.	Wind.	Weather. September 1684.	D.	Wind.	Weather. October 1684.
1	S. b. E.	Cloſe, ſome rain.	1	N. W.	Moiſt weather, ſome rain.
2	Due S.	Cloſe, ſome rain.	2	W. b. S.	Cloſe weather, but fair.
3	S. E. W.	Cloſe, rain, thunder.	3	S. W.	Cloſe morning, fair evening.
4	S. E. S. W.	Cloſe, ſome rain.	4	S. b. W.	Cloſe all day, rain at night.
5	Due E.	Cloſe morning, rain afternoon.	5	W. N. W.	Rainy morning, fair evening.
6	S. S. E.	Cloſe, ſome rain:	6	Due W.	Rainy windy weather.
7	N. W.	Fair ſun-ſhine weather, rain at night.	7	S. b. W.	Rain all day.
8	N. W.	Fair cloſe dry weather.	8	N. N. W.	Rain morning, fair evening.
9	N. W.	Sun-ſhine morning, cloſe evening.	9	N.N.N.W.	Cloſe fair weather.
10	N. W. N. E.	Sun-ſhine morning, ſome rain.	10	N. W.	Fair weather.
11	W. b. N.	Fair morning, cloſe evening.	11	S. W.	Windy, rainy morning, fair evening.
12	N. W. N.	Fair morning, ſome rain at night.	12	S. S. W.	Cloſe, and ſome wind.
13	N. N W.	Rainy weather.	13	S. S. W.	Cloſe, ſome rain.
14	Due N.	Fair ſun-ſhine weather.	14	S. S. W.	Rain, and wind.
15	N. b. E.	Fair ſun-ſhine weather.	15	S. b. E.	Wind and rain.
16	Due N.	Cloſe fair weather.	16	S. S. W.	Fair ſun-ſhine weather.
17	N. W.	Cloſe, and windy.	17	S. W.	Fair ſun-ſhine weather.
18	Due N.	Fair morning, ſome rain, fair again.	18	W. b. N.	Fair weather.
19	Due N.	Fair morning, cloſe evening.	19	N. W.	Cloſe morning, fair ſun-ſhine evening.
20	Due S.	Fair ſun ſhine weather.	20	N. W.	Fair weather.
21	S. b. E.	Fair ſun-ſhine weather.	21	Due W.	Fair ſun-ſhine weather.
22	Due S.	Fair ſun-ſhine weather.	22	Due W.	Cloſe fair weather.
23	S. b. W.	Fair morning, cloſe evening.	23	Due W.	Fair morning, wind and rain at night.
24	Due W.	Fair ſun-ſhine weather.	24	N. W.	Wind, ſnow, and rain.
25	S. b. W.	Changeable weather.	25	N. W.	Cloſe, cold, and windy.
26	Due S.	Changeable weather.	26	N. W.	Fair froſty weather.
27	Due S.	Rainy weather.	27	N. E.	Froſt and ſnow.
28	Due S.	Cloſe moiſt weather.	28	S. W. N.	Froſt and ſnow.
29	S. W.	Cloſe moiſt weather.	29	N. W.	Froſty cold weather.
30	N. W.	Cloſe morning, ſun-ſhine evening.	30	N. W.	Snow, and wind.
			31	Due N.	Cold thaw in the morning clear froſty evening.

D	*Wind.*	*Weather.* Nov. 1684.	D	*Wind.*	*Weather.* Dec. 1684.
1	*S. b. W. N.*	Thaw, Snow, Froſt.	1	*N. N. E.*	Froſt, ſun-ſhine.
2	*N. W. W.*	Froſty morning, thaw afternoon.	2	*N.*	Froſt, ſun-ſhine.
3	*S. b. W. W.*	Thawing weather all day	3	*W. S. W.*	Snow, much ſmall rain.
4	*N. W.*	Cloſe and windy.	4	*S.*	Cloudy, ſome rain.
5	*N. W.*	Cloſe and windy, little Froſt.	5	*S.*	Warm ſun-ſhine weather.
6	Due *W.*	Fair weather, little froſt.	6	*S.E.E.N E.*	Miſty, thick moiſt air.
7	*N. S.*	Fair morning, rain evening.	7	*E. N. E.*	Froſt, ſun-ſhine weather.
8	*E. b. S.*	Small rain all day.	8	*E. N. E.*	Moiſt cloudy air.
9	*S. E.*	Miſty moiſt weather.	9	*E. N. E.*	Moiſt cloudy air.
10	Due *W.*	Rainy miſty weather.	10	*E. N. E.*	Thick, moiſt air.
11	*N. W.*	Cloudy moiſt weather.	11	*E. N. E.*	Fair but cloudy.
12	*S. W.*	Cloudy moiſt weather.	12	*E. N. E.*	Cloſe.
13	*S. W.*	Cloudy, ſome ſun-ſhine.	13	*E. N. E.*	A moiſt cloſe air.
14	*S. W.*	Cloſe miſt at night.	14	*E. S. E.*	Froſt, clear ſun-ſhine.
15	*N. W.*	Froſty morning, cloſe evening.	15	*E.W. S. W.*	Froſt, cloudy.
16	*N. W.*	Cloſe morning, clear froſty evening.	16	*N. W. N.*	Froſt, cloudy.
17	*N. W. N.*	Hard froſt and clear.	17	*W.*	Froſt, cloudy, a little Snow.
18	*N.*	Hard froſt, ſun-ſhine.	18	*N.*	Froſt, ſun-ſhine.
19	*S.*	Cloſe, ſnow, Rain.	19	*W.*	Thaw, cloudy.
20	*S.*	Much rain.	20	*N. N. W.*	Rain, hail, ſnow.
21	*W.*	Warm ſun-ſhine weather	21	*W.*	Froſt, ſun ſhine.
22	*S.*	Froſt, rain.	22	*N.*	Froſt, ſun-ſhine.
23	*S. W.*	Fair, ſomewhat Warm.	23	*E.*	Hard froſt, windy.
24	*W. S. W.*	Some rain.	24	*N. E.*	Froſt, ſun-ſhine.
25	*W. N. W.*	Cloſe, fair.	25	*N.*	Froſt, cloudy, much ſnow
26	*W.*	Fair, warm, cloſe.	26	*N.*	Hard froſt, ſun-ſhine.
27	*N. W.*	Some rain.	27	*W.*	Froſt, ſun-ſhine.
28	*N.*	Cold, cloudy, rain.	28	*N. W.*	Rain all day.
29	*N. E.*	Fair, but cloudy.	29	*N W.*	Froſt, rain at night.
30	*N.*	Fair.	30	*W. N. W.*	Some rain, fair evening
			31	*E.*	Fair, Cloudy.

XXI. At *Cape Corſe* in the Latitude of 4° 49′. N. *A.* 1686, *Nov.* 24 and 25. Clear and Hot. 26. About 2 *a. m* a Storm of Rain with Thunder for ½ Hour. 27. At the ſame Hour, Rain which laſted ſomewhat longer. 28. About 5 *a. m.* ſome Rain, afterward miſty, and about 10 extream hot. 29. About 2. *a. m.* a great Storm of Rain, ſlacking often, but renewing again, it laſted about an Hour; the Day aſter clear.

The Weather at Cape Corſe, 1686, and 1687, by Mr. J. Hillier, n. 232. p. 691.

Thence to *Dec.* 7. clear; then cloudy in the Morning, between 12 and 1. *p. m.* a ſhower laſting about ½ Hour. Thence clear and hot. 10. A little Miſt in the Morning, otherwiſe very clear and hot;; ſo till 15.

15. And ſome Days after, ſomewhat thick, eſpecially in the Morning. 19. and 20. we had a dry North, and North-eaſterly Wind, call'd an *Hermitan*, and it overcame the *Sea Breeze*; found very ill for the Eyes, and moſt Men complained of a Feveriſh Temper; it was parching, but rather colder than ordinary. 21. It ceaſed; a clear Air and very hot.

23. We had the *Hermitan* again, but the Morrow it ceaſed; Then and 25. Some Clouds, but no Rain. Thence to 29, clear and hot. 29. The *Hermitan* returned, but did not continue. Thence Clouds ſometimes, but no Rain till *Jan.* 2.

This Month we had 3 Funerals, one being ſick of the Flux laid violent Hands upon himſelf, through Impatience of the Pain, the 3*d.* Day. The ſecond, upon the 25*th* died convulſively, not having been ſick above one Day. The Third, *Dec.* 17. Died of a Dropſy, which had ſucceeded a tedious Flux.

A. 1687. *Jan.* 2. About 5 *a. m.* Rain for ½ Hour, between 7 and 9 an hour, from ½ hour paſt 9, to 1 *p. m.* the reſt cloudy. 5. At 2 *a. m.* about ½ hour. 8. At 1. in the Morning about an Hour, the Days between ſomewhat cloudy. Thence to 12 extream hot.

12, and 14. Somewhat cloudy, otherwiſe the Heat continued. 17. At 7. *p. m.* a *Tornado* for above ½ Hour, and about 12 at Night, another; but the Heat very little abated.

22. Between 5 and 6. *p. m* began a *Tornado*, which laſted above an Hour, very violent, with great Claps of Thunder and Lightning. Tank fill'd 1 Foot. 23 In the Morning a great Miſt, after 8 Clear and extreme hot.

☞ The latter End of *January*, and the Beginning of *February* commonly, miſty in the Morning; after, extream hot.

Feb. 10. Somewhat cloudy and cool, till then we were troubled with Coughs, for the moſt part; about this Time they ceaſed. So the 11*th* toward Night, Thunder afar off, and Expectation of a *Tornado*; but it fail'd. 12. Extream hot 13. A ſtronger Wind than ordinary from ſea-ward. 14. Something like an *Hermitan*, but not from its uſual Quarter. Clear and Hot till about 2. *p. m.* then cloudy, but no Rain. Thence to 22, extream hot and clear. From 22 to *Mar.* 1. ſome flying Clouds without Rain; ſultry hot and unwholſome.

24. Some ſhew of a *Tornado*, but it paſs'd away.

This Month we had two Funerals.

The Beginning of *March* as the latter End of *Feb.* 5 From 6 *a. m.* for an Hour and ½ a violent *Tornado*; the Day after Cloudy. 6. Clear. 7. At Night Lightning and Clouds afar off; but nothing followed. Thence to the 11 clear and hot.

11. About 5 *a. m.* a violent Rain for almoſt ½ hour. 12 and 13, cloudy. 14. About 4 *a. m.* a gentle ſhower, but laſted not long. 15. Between 6 and 7, *a. m.* a few Drops, and likelyhood of more, but nothing followed; both Days cloudy: 16, Extream Hot. 17, ſomewhat cloudy. Thence to 20, extream hot.

20, Cloudy; about 10 *a. m.* ſome few Drops. 21, very hot. 22, In the Morning hot; about 12, a violent Rain for a Quarter of an Hour. 23, clear. 24. About 2 *a. m.* Rain for about ½ hour; the day after clear. Thence to *April* 3, clear and extream hot.

No Funeral.

April 3, At 3 *p. m.* a violent *Tornado*, but only ſome few Drops of Rain; at 5 *p. m.* a little Rain. 4, Cloudy by Fits, otherwiſe very hot. 5, Hot and clear. 6. In the Morning hot, about 2 *p. m.* cloudy; about 3, ſome Drops of Rain, in the Evening the Clouds diſperſed. 7. Clear and hot. 8, Between 12 and 1 in the Morning, a violent Rain for near an Hour; after 2, one ſomewhat longer; the Day after there appear'd to have been much Rain; Tank fill'd 2 Foot and ſomewhat more. 9, About 7 *a. m.* ſome Drops, cloudy all Day.

10, Cloudy, about 11 *a. m.* a ſmall Miſt. 11, Preſently after Midnight it began to rain, and laſted till 6 *a. m.* a great part of the Time very violently, it began with a ſtrong *Tornado*; Tank above 3 Feet. The Day after ſome Clouds; otherwiſe extream hot. So alſo 12 and 13. 14, About 5 *a. m.* a Shower for ½ hour, between 6 and 7 *p. m.* another of the ſame Continuance, the Day between extream hot. So 15, 16, A Shower for ½ hour; it began with a violent *Tornado*, the Rain not much, afterwards cloudy. 17, and 18, clear. 19, clear alſo, about 7 *p. m.* a conſiderable Wind, and Drops of Rain.

20, Clear but windy. 21, between 12 and 2, moderate Rain for near an Hour. 22, About 2 *a. m.* moderate rain almoſt an Hour; at 11 *p. m.* a ſhort ſhower and gentle: the Day between extream hot. 23, Cloudy, about 10 *a. m.* ſome Drops. 24, extream hot. 25, About 1 *a. m.* Rain for near an hour; the Morning after hot; Afternoon cloudy; moſt Part of the Night Thunder and Lightning, but no Rain. 26, At 7 *a. m.* ſtrong rain for ½ Hour, after that a little Miſt; Afternoon from 12 to 3, it rained unequally, but the moſt part moderate. 27. extream hot. 28, About 12, ſomewhat cloudy, at 3 *p. m.* it began to rain, and laſted about an hour and ½; after, cloudy and ſome Drops, in the Night a Shower or two. 29, Cloudy. Thence to *May* 6, ſometimes cloudy; but for the moſt part violent Hot.

This Month we had 3 Funerals; one on the 3*d* of a Fever, another on the 19*th* of I know not what Pains in the Guts; another on the 24*th*, of the Flux.

The 15. and ſome Days following, there ſettled upon the Caſtle Walls, certain ſwarms of winged Ants, a little bigger than Bees; they would bite very ſeverely, and were blown up with Powder.

May. 6. In the Morning Cloudy, a little after Noon ſome Wind, followed by gentle Rain, which laſted till 3. *p. m.* after, Cloudy. 7. Hot 8. Cloudy, about 10. *a. m.* a gentle ſhower for ¼ hour; about 8 *p. m.* a very violent Storm of Wind and Rain, but it quickly grew moderate, and laſted in all not above ½ hour. 9. Clear. 10. About Noon a violent ſhower for ¼ hour; after 8. *p. m.* another as long, but not ſo violent; paſt 9. another ſhorter.

11. Clear. 12. Clear; paſt 9. *p. m.* a very violent *Tornado* with Rain, which laſted ſomewhat more than 2 Hours. 13. Between 12. and 1. in the Night, a ſhort ſhower; about 9. *a. m.* ſome Drops; ſo alſo in the Afternoon, but nothing conſiderable; cloudy all Day. 14. Cloudy; at 9. *a. m.* a violent Rain for ¼; after, gentle for above an hour; about 3. *p. m.* ſome Drops. 15. About 3. *a. m.* Rain for ½ hour; between 4 and 5, another; after, Foggy and Cloudy, with ſome few Drops; about 7 *p. m.* a violent *Tornado* with Rain for near an hour. 16. About 4. *a. m.* Rain for an hour; after 8. for ¼ hour; after 6. *p. m.* Rain and Wind, but both moderate, for ½ an hour; paſt 8. about as much. 17. About 4. *a. m.* a ſhort ſhower; after, Clear. 18. Clear. 19. Cloudy, about 10. *a. m.* ſome Drops.

20. Cloudy; between 8 and 10. *a. m.* a ſhower; firſt violent, after more moderate, till it ended in a kind of Miſt; it laſted in all about 1½ hour; the Day after Clear. 21 and 22 Clear. 23. In the Afternoon Cloudy; about 6. *p. m.* ſome Drops; the Night after, a ſhower not conſiderable. 24, Hot, about 10 *p. m.* a little ſhower. 25, Clear. 26, In the Night ſome little Rain. 27, Held up. 28, at 9 *p. m.* a ſhort ſhower. 29. At 5. *a. m.* Rain till near 7; a little paſt 7 till 9. after Cloudy. 30. Cloudy; the Night after, ſome Rain. 31. About 8 *a. m.* Rain for ½ hour; from 9 till 12. it rained for the moſt part very violently; before 1. another ſhower for ½ hour; from a little after 2 till 5. with very great Thunder.

One Funeral on the 25th, after but 3 Days Sickneſs.

The Beginning of this Month, we had an extraordinary Number of Toads, which after ſometime were not to be ſeen. The 14. We had winged Ants as before.

24. Was the Firſt Corn, the Seed-time having been the middle of *March*.

Jun. 1. About 4. *a. m.* Rain for an Hour; paſt 1. *p. m.* for ½ hour; the reſt Cloudy and Miſty. 2. From 2 *a. m.* till 5. continual Rain, 'tis ſaid there was ſome before; from 9 *a. m.* till ½ hour paſt 6 *p. m.* continual Rain, ſometimes very fierce; from ½ hour paſt 9 at Night, Rain till paſt 10. 3. From 6. to a little paſt 7 *a. m.* a very gentle Rain; from thence till 1 *p. m.* moſt commonly very fierce; thence for a little while more moderate, but it rained hard again till 6 *p. m.* then it droped but ſlowly, and ſo continued till about 7. In the Night ſome little rain. 4, About 8 *a. m.* ſome Drops, thence Clear. 6 and 7 Clear, except ſome few flying Clouds. 8, After 3 *a. m.* gentle Rain for near an hour; then Cloudy and ſome Drops, after 10 *p. m.* a ſhower. 9, At 5 *a. m.* a gentle ſhower, laſted till paſt 7; thence a very violent Rain till almoſt 9; ſome Drops after that; about 3 *p. m.* it began and rained till paſt 10, ſomewhat moderately. 10. Clear and Hot.

11. Clondy; about 8 *p. m.* a few Drops. 12, From about 2 *a. m.* till near 5, Rain, but not violent; a little before 6. a furious Storm of Rain, but little Wind, it laſted till ½ hour paſt 7. About 3 *p. m.* a moderate Rain, till a little paſt 4. And from thence to 6, ſomewhat more than a Miſt, the Night after it rained a little. 13, Cloudy, in the Afternoon it drop'd a little. 14, About 8 *a. m.* a few Drops. 15, Somewhat Cloudy. 16, Extream Hot, towards Night Cloudy, about 5 *p. m.* a violent ſhower for ½ hour, from a little before 8. till paſt 10. it rained continually. 17, From 4 *a. m.* till almoſt 6, gentle Rain, ſo from a little paſt 6 till paſt 7. thence till paſt 3. *p. m.* Cloudy, and now and then ſome Drops, then a violent ſhower for ⅛ of an hour; half an hour after 4 it rained again, and contiuned till paſt 10, for the moſt part very furiouſly; with ſome little intermiſſion it rained all Night. 18, At 3 *a. m.* It rained very fiercely; about ½ hour after 6. it held up, but Cloudy ſtill; from 8 *a. m.* till paſt 3 *p. m.* it rained, but moderately; then it held up a little, but rained after till paſt 6, all Day Cloudy, and at Night a great Fog. 19, About 9, *a. m.* ſome Drops; from 1 till paſt 3. *p. m.* very gentle Rain.

Thence to the firſt of *July*, Foggy, Morning and Evening, ſometimes Hot, but for the moſt Cloudy, and more Temperate than could be expected from the Climate.

Two Funerals, one the 9th of an Aſthma; The other the 21 of a Fever.

We ſaw ſome ſorts of Inſects not uſual here, whether Monſtrous or not I cannot tell. The moſt notable, a kind of Spider about the Bigneſs of a Beetle, the Form neareſt of a Crab Fiſh, with an odd kind of Orifice Viſible in the Belly, whence the Web proceeded.

Jul. 1. Extream Hot. 2, Foggy in the Morning; about 9 *a. m.* a few Drops; after, Clear. 3, In the Morning a great Fog; about 9 *a. m.* it rained ſmall Rain for near an hour; toward Night more Foggy than ever before; about 6 *p. m.* ſmall Rain for a little time, from 8 till paſt 9. ſomewhat more brisk Rain, after that it cleared up. 4, From 9 *a. m.* to 3 *p. m.* ſmall rain, the reſt Foggy; between 10 and 11 *p. m.* ſome rain. 5, From 2 *a. m.* till paſt 8, conſtant rain, ſometimes very fierce, ſometimes moderate, about 10 *a. m.* ſome rain; between 2 and 3 *p. m.* it began to rain, but continued not long; from 8 *p. m.* to 10. rain. 6, From about 2 *a. m.* to 6, rain; after, fair. 7, Foggy and Cloudy, between 7 and 8 *a. m.* ſome Drops. 8, Foggy in the Morning, otherwiſe Clear and Hot. 9, About 1 *a. m.* a ſmart ſhower; between 3 and 5, ſome more rain. The Day after

Foggy. 10; Very Dull and Cloudy; from 3 *p. m.* till Night, a very great Miſt.

11. Tolerably Clear, and very Hot, yet ſomewhat Foggy Morning and Evening. 12, Cloudy; thence to 15. in the Morning and Evening Foggy; elſe very Hot. 15. Cloudy; about 10, *a. m.* ſome Drops; from ½ Hour paſt 2 till 4, moderate Rain; about 7, ſome Drops. Cloudy, ſeveral times it dropped a little, but nothing conſiderable. 17, A little before Day, a ſhort Shower; after, Cloudy; thence to 20, Foggy Morning and Evening, and the moſt part Cloudy.

20. Very clear all Day, and extream Hot. 21, Not Foggy at all; yet ſomewhat Cloudy, but about Mid-day it cleared up. 22, and 23. Very clear and extream Hot. 24, Cloudy in the Morning; after, as the Two laſt. 25, Cloudy, but not Miſty nor Foggy; Sultry Hot. 26, In the Morning Cloudy; after, extream Hot. 27, Hot and clear. 28, Thin clouds, through which the Sun ſhone very Hot. 29, and 30. Cloudy. 31. About 3 *a. m.* Two ſhort ſtorms of Rain, the Day after Clear and Hot.

Two Funerals; one the 17. Drowned; the other 21. of a Fever.

Aug. 1. to 5. Clear, for the moſt part in the Mornings Cloudy; but without Fogs; ſometimes very Hot. 5. About 5. *a. m.* a Shower near an hour long, about 7 another for ½ hour; till 10, ſome ſmall Rain; thence Cloudy till 1. about 7. *p. m.* a few Drops. 6. Cloudy all Day, ſometimes it dropp'd a little. 7, About 2 *a. m.* Violent Rain with Wind for above ½ hour. The Day after, Cloudy. 8, and 9. Cloudy and Foggy. 10, More Foggy than ordinary; about 10 *a. m.* a great Miſt, or ſmall Rain for the moſt part of the Day after.

11. Foggy as the former and Miſty; between 8 and 9 *a. m.* a Shower of ſmall Rain; Afternoon, Clear. 12, Small Rain in the Morning; after, as 11. 13, Clear and Hot, the *Land Breeze* very ſtrong. 14, Cloudy all Day, the *Land Breeze* turn'd to a kind of *Hermitan*, but not troubleſome, nor continued beyond this Day. 15, Cloudy, ſeveral times very Miſty, and ſome ſmall Rain. 16, Cloudy, but no Miſt; Afternoon, Clear. Thence to 22. Clear and Hot, but the Nights Colder than at other times.

22. At 6 *p. m.* Cloudy, a Wind *Tornado* but moderate, with ſome Drops of Rain very large. 23. Clear and Hot. 24. Cloudy and Miſty at firſt; about 10 *a. m.* Clear and Hot. 25. Clear and Hot. 26. Very Foggy, Morning and Evening; for the reſt, Hot. 27. From 5. to 10 *a. m.* it rained ſmartly; thence Cloudy; about 2 *p. m.* it cleared up for a while; about 9 *p. m.* a ſharp Rain for ¼ hour; 28, Between 12 and 3 *a. m.* it rained about two Hours; about 7 ſome few Drops; after, Cloudy; in the middle of the Day it cleared a little, but quickly Overcaſt again. 29, In the Night ſome Rain; at 7 *a. m* Rain for ¼ hour; till paſt 12 a very thick Miſt; about 3 *p. m.* Clear; at Night a very thick Miſt. To the end Cloudy and Miſty.

Three Funerals; 6. one of a Fever; 7. another of a Conſumption; 29, a third of a Fever.

Sept. 1, and 2. as the laſt. 3. Some few Drops. Thence to 8, Cloudy alſo and Miſty. 8. About 6 *p. m.* ſome ſmall Rain; between 8, and 10 *p. m.*

for an hour pretty briſk Rain. 9, In the Morning Cloudy and Miſty. 10. About 10 *p. m.* a little Rain.

11. Extream Hot and Clear; in the Night conſiderable Rain for ſeveral Hours. 12, About 10, *a. m.* ſome ſmall Rain, the Morning very Foggy, Afternoon Clear. 13, Clear and Hot. 14, and 15, In the Morning Extream Cloudy, and ſome Drops of Rain. 16, Clear and extream Hot. 17, Moderate, about 7 *p. m.* ſome Drops; at Night alſo ſome Rain, not conſiderable. 18, Cloudy; in the Morning about 12, ſome Drops; all this Week, Morning and Evening Foggy and Thick. 19, 20 21. Extream Hot; the Foggs ceaſed.

22. About 1. *a. m.* ſome Rain, the Day after Cloudy. 23, 24, 25. In the Morning Cloudy; after, very Hot. 26. At Night alſo ſomewhat Miſty, with many Flaſhes of Lightning, but no Thunder. The like Flaſhes moſt Nights to the End of the Month, alſo often Cloudy; at other times extream Hot.

Two Funerals; One 19. of a Fever; the Other 26. whoſe diſceaſe I do not know.

Octob. 1. About 3. *a. m.* a very fierce Rain for near an Hour, milder towards the End; the Day after ſome Flying Clouds. 2. About 4. *a. m.* a little Rain, the Day after as before; from 8 *p. m.* till 10. moderate Rain. 3. Cloudy; about 10. *a. m.* Rain for ſomewhat more than an hour. 4. Cloudy between 8. and 10. *p. m.* a very ſmart Rain for above an hour. 5. About 9. *a. m.* a little ſhower. 6. About 5. *a. m.* a little ſhower; another paſt 6. The Day after, and 7. extream Hot. 8. Hot in the Morning; after Noon a ſhew of a *Tornado*, with Thunder, and a conſiderable Wind; but no Rain.

Thence to 16. ſome flying Clouds, but generally Hot. 16. About 4. *p. m.* a little Rain, the Sun ſhining then, and the whole Day very Hot; a-8. *p. m.* a very ſtrong *Tornado*, Wind and Rain for about ½ hour, afterward the Rain continued, but more moderate, for near two hours. 17. Clear and Hot. 18. So too, except that about about 3. *p. m.* there was a very ſhort ſhower. 19. and 20. ſomewhat Cloudy.

21. About 7. *a. m.* a few Drops; after, Clear and extream Hot, but quickly Cloudy again; at 11. *a. m.* a violent *Tornado*, with very ſtrong *Rain* and *Thunder* for near an hour; thence all the time till Night, thick and Miſty; till 2. *p. m.* Rain. 22 Cloudy. 23. Clear and Hot. 24. Somewhat Cloudy; at 7. *p. m.* a little Rain. 25. Cloudy; about 11. *a. m.* Expectation of a *Tornado*, with ſome *Thunder*, but it ended in a few Drops of Rain about 1. *p. m.* 26. About 2. *a. m.* a very violent *Tornado*; and after the Wind, Rain not very fierce, which laſted till 8. *a. m.* the Day after Cloudy. 27. About 10. *p. m.* a violent Wind with Rain, but it laſted not long. 28. About 3. *a. m.* a ſtrong Rain for near an hour, the Day after extream Hot. 29, and 30. Hot yet with ſome Clouds 30. Half an Hour after 11. *p. m.* began a very furious *Tornado*, the Wind was quickly over, but the Rain laſted with extream Violence about 2 hours. 31. In the Morning very Hot, about 2. *p. m.* a violent *Tornado*, with *Rain* and *Thunder* very near, it

ceaſed ſometimes, but beginning again, laſted till near 4 *p. m.* afterward cloudy.

Three Funerals all upon the 6th Day; two of Fevers, the other I know not.

Nov. Clear and extream hot till the 6*th.* 6, About ½ hour paſt 1 in the Morning, a very violent Rain for more than an hour.

Thence to 14, except that the 11*th* at *Night*, there were ſome few Drops, very hot.

14. Extream hot, about 9 *p. m.* a little Shower; the ſame Night about 1, a ſmart Rain for an Hour and half. 15. Hot; toward Night cloudy and foggy. Thence to 19 very hot. 19. Some likelyhood of a *Tornado*, but nothing followed.

20. About 1 *p. m.* a ſhort Shower, about a quarter paſt 2 another not much longer; till Night cloudy. Thence to 26 no Rain, but cloudy and ſomewhat cooler; yet ſome Days extream hot. 26, About 10 *p. m.* a ſhort Shower. 27, About 2, another, the reſt clear. 30, About 2 *a. m.* fierce Rain for about half an hour.

This laſt Year has been the wetteſt and moſt cloudy of any that can be here remembred; yet the Air has been clearer than it uſes to be in *England* one Day with another. Ib. p. 691.

A *Tornado* is a violent Storm of Wind, followed commonly by Rain, but not always; the Wind ceaſes not preſently upon the Rain, but after, ſometimes it does: In this Place it comes (as does an *Hermitan*) moſt frequently from the North, taking in the next Points, whether to the Eaſt or Weſt, but chiefly the Eaſt, tho' I have ſeen both that and an *Hermitan* from other Points; ſo the Account is not without Exception. There are in it ſhort uncertain Blaſts, from all Quarters, which I believe reach not many Yards, but the general Wind (for ought that I ſee) is not ſo unconſtant; Veſſels that go to windward are helped by them, when they are not over-ſtrong, for they are oppoſite to the *Sea Breeze*, and they can ſteer by them a regular Courſe; which ſure they could not do, if they were very irregular. They never fail to give Warning beforehand, tho' ſometimes after that Warning they do not follow; there is a very black Cloud appears afar, in which if there be a kind of white Spot, the Wind will be moſt, if not the Rain; this the Sailors ſay. Sometimes there is that Mark, ſometimes not; tho' I doubt the Prediction from it is not very certain; as neither are any perhaps of that kind. Ib. p. 692.

XXII. *The Rain at* Greſham College; 1695, *and* 1696, n. 223.p.357.

M.	D.	lb.	Oun.	gr.
Aug.	19	2	6	216
	26	4	6	246
Sept.	2	0	4	96
	9	3	10	397
	16	0	1	204
	23	0	6	336
	30	4	1	444
Oct.	7	2	3	96
	14	0	2	60
	21	0	1	234
	28	0	0	458
Nov.	4	0	0	207
	11	1	11	65
	18	1	1	309
	25	0	9	285
Dec.	2	0	8	126
	9	3	7	324
	16	1	3	435
	23	0	1	60
	30	5	8	92
Jan.	6	4	10	105
	13	0	1	12
	20	1	10	450
	27	1	5	82
Feb.	3	6	11	372
	10	4	9	242
	17	0	6	291
	24	0	2	180
Mar.	2	0	9	12
	9	0	2	459
	16	0	0	396
	23	4	4	263
	30	1	5	285
Apr.	6	2	4	375
	13	1	0	294
	20	2	2	000
	27	0	7	390
May	4	4	10	45
	11	7	6	0
	18	5	2	105
	25	1	7	60
Jun.	1	0	0	99
	8	6	6	150
	15	0	2	120
	22	7	5	285
	29	1	5	84
July.	6	0	1	120
	13	16	1	0
	20	1	7	240
	27	6	1	256
Aug.	3	1	10	120
	10	1	11	90
	12	0	0	0

This Account of the Quantities of Rain fallen in one Year in *Greſham College*, *Lond. per* Month, begun *Aug.* 12. 1695, and the Rain was weigh'd every *Monday* Morning till *Auguſt* 12, 1696, by Pounds, Ounces and Grains, *Troy* Weight: The Diameter of the Veſſel which receives the Rain being 11,4 Inches, whoſe Area is a little more than 102,1 Inches.

lb. *Oun.* *gr.*
The Sum amounted to 131 7 113. which is equal to 29,11 Inches in a Cylinder of the aforeſaid Diameter, *viz.* 11,4 Inches.

Fig. 18. *ABCD* is a Frame to ſurport the Glaſſes. *E* is a large Bolt-head, with a Neck of 20 Inches long, and capable of holding above 2 Gallons. *F* is a Funnel, whoſe Diameter is 11 Inches, and $\frac{4}{10}$ from *G*, to *H*. *I*, *K*, are two Stays, or Pack Threads, which are ſtrained by two Pins, *L*, *M*, to hold the Tunnel ſteddy againſt the high Winds. *N*, the Pipe of the tunnel, at *N* being no wider than $\frac{1}{4}$ of an Inch, through which the Evaporation can be but little.

XXIII. *The Weather 1697 at Upminſter, in Eſſex, by Mr Wm. Derham, n. 237. p. 47.*

JANUARY 1697.

D.	*h.*	*Weather.*	*Winds.*	*Barom.*		*Rain.*		*D.*	*h.*	*Weather.*	*Winds.*	*Barom.*		*Rain.*	
	8	Froſt.	W.S.W.	30	07				8	Froſt	N.	30	02		
1.	12			30	07			17.	12	Cloudy	N.N.W	30	02		
	9	Fair		30	04				9	Calm		30	04		
	8			30	05				8	Froſt	W.	30	09		
2.	12	Miſling	S.	30	06			18.	12	Fair	S. W.	30	10		
	9			30	05				9			30	10		
	8	Fog	S.b.W.	30	07				8						
3.	12	Cloudy	S.	30	11			19.	12						
	9			30	15				9						
	8			30	18	0	50		8	Fair					
4.	12	Miſling	S.	30	18			20.	12	Froſt					
	9			30	18				9	Cloudy	S.w. b.w	30	20		
	8	Calm		30	22				8						
5.	12	and	W. b. S.	30	23			21.	12						
	9	Cloudy	S. W.	30	26				9						
	8	Fog		30	22				8	Cloudy	W.	29	95		
6.	12	Warm	W.	30	00	0	30	22.	12	Thaw	W.b.N.	29	90	0	08
	9	Miſling		30	14				9	Rain		29	95		
	8		N.b.W.	30	05				8	Froſt	N. W.	29	90		
7.	12	Cloudy	N. W.	30	05			23.	12	Snow	N. W.	29	80	0	30
	9								9	Fair	N.N W	29	68		
	8		N. W.	29	94				8	Snow	N.w.b.w.	29	64		
8.	12	Cloudy	N. W.	29	90			24.	12	Storm	N.	29	67	0	20
	9			29	82				9	Snow	N. E. N b. E.	29 29	78 95		
	8	Sunſhin.		29	51				8	Froſt	E.	29	95		
9.	12	Rain	S.	29	38			25.	12	Fair.	E. b. N.	29	97		
	9	Snow.		29	10	1	20		9		N. E.	29	98		
	8	Froſt	S. W.	29	02				8	Sharp	N. E.	29	96		
10.	12	Thaw	S.	29	00			26.	12	Froſt	N. b. E.	29	96		
	9	Rain	S. by E.	28	95	0	70		9		N. N. E.	29	86		
	8	Cloudy		29	46				8			29	77		
11.	12	Fair.	N.	29	00			27.	12	Froſt.	N. E.	29	77		
	9			29	77				9			29	74		
	8		N.	29	83				8	Cloudy	S.	29	65		
12.	12	Sleet						28.	12	Froſt	N. E.				
	9								9			29	60		
	8								8	Snow	S.	29	47		
13.	12	Cloudy						29.	12	Thaw	S. W.	29	31	0	08
	9			29	91				9			29	29		
	8		N. E.	29	96				8	Froſt	S. W.	29	41		
14.	12	Snow	N. E.	29	96	0	20	30.	12	Fair	W.	29	50		
	9		E. N. E.	29	98				9		W. b. S.	29	54		
	8	Froſt	E. N. E.	29	94				8	Froſt	W.	29	77	0	05
15.	12	Cloudy	E.	29	92			31.	12	Fair	N.N. W	29	86		
	9			29	90				9		N.b. W.	29	95		
	8	Froſt	E. N. E.	29	99							Total		3	61
16.	12	Cloudy	NE.b.N	29	91										
	9			29	94										

FEBRUARY 1697.

D.	h.	Weather.	Winds.	Barom.		Rain		D.	h.	Weather.	Winds.	Barom.		Rain	
	7								7	Rain		29	50		
1.	12	Froſt						17.	12	Fair	S.	29	52	0	20
	9			30	06				9	Rain		29	52		
	7	Cloudy		30	05				7	Cloudy	S. b. E.	29	3		
2.	12		N. E.					18.	12	Bluſtrin	S.	29	26		
	9	Froſt		29	95				9	Fair		29	42		
	7	Cloudy	N.E.*b*.E	29	75				7	Rain	E. b. S.	29	30		
3.	12	Froſt	E.	29	66			19.	12		S.	29	33	0	05
	9	Calm	S.	29	50				9	Fair		29	39		
	7	Cloudy		29	30				7		S. E.	29	46		
4.	12	Thaw	E. b. S.	29	26	0	02	20.	12	Froſt	E. b. S.	29	46		
	9	Sleet		29	20				9		E.	29	40		
	7	Snow		29	20				7			29	36		
5.	12	Fair	E.	29	20	0	03	21.	12	Fair	E.	29	37		
	9	Froſt		29	19				9			29	45		
	7	Froſt	N. b. E.	29	05				7	Rain		29	47		
6.	12	Cloudy		29	02	0	03	22.	12		E.	29	48	0	03
	9	Snow.	N.	28	90				9	Fair		29	52		
	7	Snow	N.	28	86				7	Hoar-F.	E.	29	52		
7.	12	Cloudy	W. b. S.	28	83	0	01	23.	12	Fair	S.	29	54		
	9		S. b. W.	28	83				9	Rain	S.	29	60		
	7	Fairer		28	82				7			29	68		
8.	12	Sleet.	S. W.	28	84	0	01	24.	12	Fair	S. b. w.	29	77	0	04
	9			28	97				9	Rain		29	81		
	7	Thaw		29	10				7	Cloudy		29	84		
9.	12	Froſt	S. W.	29	18			25.	12	Bluſter	S.	29	85		
	9			29	25				9	Fair		29	88		
	7	Froſt	S. W.	29	43				7	Fair	S.	29	88		
10.	12	Fair	S.w.b.w	29	52			26.	12	Cloudy				0	10
	9			29	61				9	Rain	S. W.	29	92		
	7	Snow	S. b. E.	29	65				7	Miſling	S.	29	93		
11.	12	Rain	S. E.	29	76	0	27	27.	12	Fair	S. b. W.	29	97		
	9	Fair	E.	29	94				9	Calm	S. S. W.	29	98		
	7	Cloudy	E. b. S.	30	08				7	Cloudy		30	01		
12.	12	Froſt.						28.	12	Fair	S. W.	30	01	0	0
	9			30	08				9	Cloudy		30	40		
	7	Thaw		30	00										
13.	12	Warm	S.	30	00										
	9	Cloudy		29	95										
	7	Calm	S.	29	88										
14.	12	Rain.	S. b. W.	29	87	0	40								
	9		S.	29	80										
	7	Miſt	N.	29	85										
15.	12	Warm	N. W.	29	86	0	30								
	9	Rain.	E.	29	80										
	7	Cloudy	S. b. E.	29	54										
16.	12		W. S. W.	29	62	0	28					Total.		1	8
	9	Fair		29	60										

MARCH. 1697.

D.	h.	Weather	Winds.	Barom.		Rain.	
1.	7	Cloudy		30	12		
	12		S. W.				
	9	Fair		30	20		
2.	7	Cloudy	W.S.W.	30	18		
	12	Warm	S. W.	30	15		
	9	Spring		30	14		
3.	7	Fog	S.	30	02		
	12		W.	29	9[illegible]		
	9	Fair	W. b. S.	29	88		
4.	7	Miſt		29	75		
	12	Rain	S. W.	29	69	0	13
	9	Fair		29	65		
5.	7	Fair	S. W.	29	71		
	12	Colder		29	70		
	9		S.	29	46		
6.	7	Rain	S. W.	29	20		
	12	Bluſter	W.	29	12	0	85
	9	Fair		29	21		
7.	7	Fair	W.	29	48		
	12	Colder	W.b.N.	29	57		
	9	Bluſter	W.	29	60		
8.	7	Froſt	N. W.	30	08		
	12		N.	30	11		
	9	Fair	N. b E.	30	15		
9.	7	Froſt	E.	30	15		
	12		W.	30	14		
	9	Fair	S. W.	30	08		
10.	7	Miſt	S. W.	29	95		
	12		S.W.b.S.	29	90		
	9	Fair	S. b. W.	29	76		
11.	7	Miſt	S.	29	65		
	12	Froſt	W. b. S.	29	64		
	9	Cloudy		29	60		
12.	7	Rain	N. W.	29	47		
	12	Fair	W.S.W.	29	35		
	9	Rain	W.b.N.	29	21		
13.	7		N.b.W.	29	18		
	12	Rain	N.	29	25	0	32
	9		N.	29	35		
14.	7	Froſt	N.	29	59		
	12	Fair	W.	29	60	0	02
	9	Cloudy	W.	29	48		
15.	7	Fair		29	40		
	12	Bluſter	W.	29	48		
	9	Storms		29	28		
16.	7	Fair		29	04		
	12	Hail	W.	29	04	0	82
	9	Snow		28	93		
17.	7	Froſt		29	16		
	12		N. W.	29	30		
	9	Fair		29	32		
18.	7	Froſt	S.	29	10		
	12	Snow	N. W.	29	10		
	9		W.	29	16		
19.	7	Froſt	W. b. S.	29	27		
	12	Fair	N. W.	29	41		
	9		S.W.b S.	29	43		
20.	7	Froſt	S.	29	42		
	12	Snow	S. S. E.	29	37	0	52
	9	Fair	S. E.	29	25		
21,	6	Bluſt	E. b. N.	29	07		
	12	Cloudy	E b. N	29	10		
	9	Hazy	N.N.E.	29	24		
22.	6						
	12						
	9						
23.	6						
	12						
	9	Froſt	N. E.	29	40		
24.	6	Froſt	N.	29	46		
	12		N.N.W.	29	54		
	9	Fair	N. b. E	29	70		
25.	6	Froſt	N.b.E.1.	29	78		
	12		S. 1.	30	02		
	9	Fair	S. o.	30	11		
26.	6	The	E. o.	30	11		
	12	ſame	S. E.b.E.1.	30	10		
	9			30	04		
27.	6			29	97		
	12	Same	B. o.	29	98		
	9			30	07		
28.	6	Same	E. o.	30	13		
	12	Hazy	E. o.	30	15		
	9		E. 1.	30	20		
29.	6	Cloudy	N.E.b.N.o	30	14		
	12	Cold	N.N.E.1	30	12		
	9			30	12		
30,	6	Cloudy	N. 1.	30	12		
	12	warmer	N.N.E.	30	12		
	9			30	05		
31.	6	Cloudy	N. 1.	29	96	0	02
	12						
	9	Rain	N. by E.	29	88		
				Total		2	68

APRIL. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain.		D.	h.	Weather.	Winds	Barom.		Rain.	
	6	Cloudy		29	83				6		N.b.W1	29	96		
1.	12	Warm	N. E. o.	29	83			17.	12	Fair		29	96		
	9	Fair		29	84				9		N. 1	29	94		
	6		N. 1.	29	88				6	Fair	N. o	29	91		
2.	12	Fair	N. E. 2.	29	88			18.	12	Hot	E. N. E.	29	93		
	9			29	87				9	Day		29	95		
	6	Fair	N.E.b.E.1.	29	83				6			29	93		
3.	12	Want of	E. 1.	29	82			19.	12	The	E. 1				
	9	Rain		29	82				9	ſame		29	80		
	6	Miſling	N. o.	29	75				6	The	E. o.	29	69		
4.	12	Cloudy						20.	12	ſame	S. 1	29	60		
	9	Fair		29	68				9		S. o	29	52		
	6	Cold		29	68				6	Cloudy	E.b. S. o	29	35		
5.	12	Fair	N. b. E	29	68			21.	12	Fair	E.b. S. 1	29	21	0	43
	9	Miſling		29	74				9	Rain	S.b.E.1	29	10		
	6	Froſt		29	73				6	Cloudy	E. 1	29	08		
6.	12		E.	29	71			22.	12	Rain	S. 1	29	05	0	30
	9	Fair		29	68				9	Fair	S. E. o	29	15	0	62
	6	Froſt		29	66				6	Fair	E. o	29	20		
7.	12	DrySea-	E.	29	67			23.	12	Rain	S.b.E.1	29	22	0	06
	9	ſon		29	70				9	Fair	S. E	29	27		
	6	Froſt		29	71				6	Rain	S. E. 1	29	31		
8.	12		E.	29	70			24.	12		N.N.W	29	32	1	24
	9	Warmer		29	71				9	Thunder	E.	29	34		
	6	Fog	W.	29	66				6	Showers	E. b. N.	29	28		
9.	12	Fair	W.	29	64			25.	12		E.	29	27	0	75
	9	Cloudy		29	64				9	Fair	E. o.	29	18		
	6	Warm	E. o.	29	61				6	Cloudy	S.	29	14	0	65
10.	12	and	E.b.S.1.	29	61			26.	12						
	9	Fair		29	60				9						
	6	Fair	E. o.	29	60				6						
11.	12	Warm	E. 1.	29	63			27.	12						
	9	Cloudy	N.b.E.2.	29	64				9						
	6	Fair	N.N.E.2	29	65				6						
12.	12	Cloudy	N. b. E.	29	67			28.	12						
	9	Rain		29	70				9						
	6	Cloudy		29	72				6						
13.	12	Rain	N. E.			2	38	29.	12						
	9			29	78	0	30		9						
	6		N. N. E. o.	29	75				6						
14.	12	Fair	E.b.N.o	29	76			30.	12						
	9			29	76				9						
	6	Fair		29	77										
15.	12	Warm	E. 1.	29	77									0	8
	9	Spr.Day		29	73										
	6	Fair	E. o.	29	73										
16.	12			29	75							Total		7	5
	9	Cloudy	N. o.	29	86										

MAY. 1697.

D.	*h.*	*Weather.*	*Winds*	*Barom.*	*Rain.*
	6	Cloudy			
17.	12	Miſling		29 65	3 0
	9	Bluſtr	S. W. 2.	29 55	
	6	Rain	W. 2.	29 57	
18.	12	Fair	Wb.N. 1	29 65	0 19
	9			29 74	
	6		W.b.S.1	29 79	
19.	12	Fair	E. 1.	29 85	
	9			29 92	
	6	Fair	E.b.N.o	29 99	
20.	12		N.2.	30 02	
	9	Cool	N.b.E.o	30 07	
	6	Cloudy	N. o	30 08	
21.	12	Cold	N.b.E. 1	30 08	
	9	Fair	N.b.E.o	30 11	
	6	The	N.b.E.o	30 07	
22.	12	ſame	N.b.E.o	30 07	
	9		E. o	30 02	
	6	Cloudy	E.	29 98	
23.	12	leſs cold	E.b.N.o	29 93	
	9	Fair	E.b.N.o	29 88	
	6	The	N.b.E.o	29 85	
24.	12	ſame			
	9		E. o.	29 88	
	6	Miſt		29 88	
25.	12	Hot and	E. o		
	9	Dry		29 85	
	6	The	E. o	29 83	
26.	12	ſame	E. 1	29 80	
	9		E o	29 73	
	6	Fair	N. o	29 65	
27.	12	Little	N. 1	29 65	0 01
	9	Rain		29 75	
	6	Fair	N. o	29 82	
28.	12	Warm			
	9		S. o	29 74	
	6	Fair	S. o	29 79	
29.	12	Hot	E. o	29 75	
	9		E. 1	29 73	
	6	The	E.	29 73	
30.	12	ſame		29 76	
	9		S. o	29 80	
	6	The		29 80	
31.	12	ſame	S. o		
	9			29 75	
				Total	3, 20

JUNE. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Fair		29 66	
1.	12	Hot	S. o.		
	9	Rain		29 56	
	6	Rain	S. o.	29 42	
2.	12	Shine	S. 1.	29 29	0 44
	9	Rain	S. 1	29 10	
	6	Fair	S.b.W. o	29 08	0 79
3.	12		S. 1	29 04	
	9	Showers	S. 1	29 02	0 37
	6		S. W. 2	29 18	
4.	12	Cloudy		29 38	
	9		S. 1	29 58	
	6	Cloudy		29 72	
5.	12	Sultry	S. b. W. 1	29 83	
	9	Hot.		29 85	
	6	Thun.	E. b. S.	29 85	
6.	12	Rain	E. o	29 82	1 13
	9	Thun.		29 74	
	6	Fog	S-b. W.	29 70	0 02
7.	12	Fair	S: W: 1	29 71	
	9	Hot	S.W.b.W.	29 72	
	6	Fair	S.W.b.W.	29 70	
8.	12				
	9	Cloudy	S: o	29 56	
	6		S:b:E:o:	29 50	
9.	12	Fair	S: 1	29 48	
	9	Rain	S: o:	29 51	
	6		S:b:E:o:	29 60	
10.	12	Fair	S:b: W:1	29 68	0 01
	9		S:o	29 75	
	6		S:	29 75	
11.	12	Fair	S:		
	9		E: o	29 65	
	6	Cloudy	N:W:1:	29 60	
12.	12	Fair	N.W.b.W.	29 55	
	9		N:W:o:	29 49	
	6		W: o:	29 40	
13.	12	Fair	S: W: o:	29 34	
	9		S: W: o:	29 28	
	6	Fair			
14.	12				0 02
	9	Rain	E: o:	29 38	
	6	Miſty	E: o:	29 45	
15.	12	Fair			
	9	Hot	N.b.W. 4	29 64	
	6			29 78	
16.	12	Cloudy	N: 1:		0 01
	9			29 90	
	6	Cloudy	N.	29 90	
17.	12	Fair	W. 1.	29 92	
	9	Sultry	W. o.	29 94	
	6	Very	W. b. S. o	29 98	
18.	12	Drough	W. b. S. 1	30 00	
	9	ty.	S. W. o.	30 00	
	6	Hot	SWbW2,	29 93	
19.	12		W.b.E. 1	29 91	0 22
	9	Rain	N. E. o.	29 93	
	6	Cloudy	N.b.E,o.	29 92	
20.	12			29 92	
	9	Cooler.	N. 1	29 96	
	6	Cloudy	N. o	30 00	
21.	12	Much			
	9	Cooler	N.E. 1	30 02	
	6		N. o	30 01	
22.	12	Fair	E. 1.		
	9		N.E.b.N.o	29 90	
	6	Cloudy	N. o.	29 80	
23.	12	Rain	E. 1	29 79	
	9	Fair		29 79	
	6	Great	N.E.b.E. 1	29 77	
24.	12	Drought	E. 1	29 78	0 10
	9			29 78	
	6	Cloudy	N.E.b.E.o.	29 74	
25.	12	Dry	N:E:1.	29 73	
	9		E 1	29 71	
	6	Sultry		29 71	
26.	12		E. o	29 71	0 05
	9	Dry		29 73	
	6	Miſt	E. o	29 74	
27.	12	Rain	E. b. S.	29 73	0 29
	9	Thun.	S. o	29 74	
	6	Miſt		29 81	
28.	12	Hot and	S. 1.	29 83	
	9	Dry		29 86	
	6	Dry	E. o	29 85	
29.	12	Burning	E. 1.	29 85	
	9	Day	S. o	29 87	
	6	Fair	S. W. o.	29 88	0 97
30.	12			29 88	
	9	Rain	S 1.	29 08	0 31
				Total	4 91

JULY 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Rain	S. S. W.	29 75	
1.	12		S. W. 1.	29 72	
	9	Fair	S. W. o	29 70	0 24
	6		S W. o.	29 67	
2.	12	The ſame.			
	9		S. W. 1.	29 59	0 22
	6		W.bN.1	29 64	
3.	12	Fair		29 75	
	9		W. o	29 84	
	6	Cloudy	S. o.	29 85	
4.	12	Fair	S. W. 1.	29 85	
	9	Hot	S. W.	29 85	
	6	Fair	W. o.	29 87	
5.	12	Cool			
	9	Breezes	W. 1.	29 99	
	6	Hot	W. o.	29 95	
6.	12	Dry	W.b.S.1.	29 94	
	9	Day		29 90	
	6	Fair	W.b.No	29. 86	
7.	12	Hot			
	9	Rain	W.b.S.o	29 79	0 12
	6	Miſling	S. W. 1.	29. 68	
8.	12	Rain	S. W. 2.	29 60	
	9	Cloudy	S.S.W.1.	29 44	0 32
	6	Rain	S. W. 1.	29 42	0 75
9.	12	Cool	S. W. 1.	29 43	
	9	Fairer	W.N.W.o.	29 47	0 77
	6	Fair	W.b No	29 58	
10.	12	and	W. 1.	29 71	
	9	Cool	NW.b.W	29 83	
	6	Rain		29 85	
11.	12	Warmer	S. W. 1.	29 85	
	9			29 93	0 50
	6		S.W.bW	30 00	
12.	12				
	9				
	6	Fair			
13.	12	and			
	9	Hot	S. o	29 98	
	6	Fair	S. o.	29 90	
14.	12		S.b.W.1	29 88	
	9	Cloudy	S. W. 1.	29 84	
	6	Rain,	Nb.W.1	29 84	
15.	12	Cloudy	W. 1.	29 85	0 48
	9	Fair	N. W. o.	29 90	
	6	Cooler	W. 1.	29 95	
16.	12	Rain	N.W.b	29 94	
	9	Thun.		29 92	0 42
	6	Fair	Wb.N.o	29 91	
17.	12	and	N. o.	29 93	
	9	Cool	N.N.W.o.	29 93	
	6	Fair	N.W.1.	29 95	
18.	12	Cloudy			
	9	Rain	N. 1.	29 98	
	6	Miſling	N.	29 98	
19.	12		WN.W.1	30 0	0. 62
	9	Cloudy			
	6				
20.	12	Showry			
	9		W.b.S.1	29 88	
	6	Rain	W.S.W.1	29 75	
21.	12	Fair	W.b.N.1.	29 1	
	9	Miſling	W. 1.	29 60	
	6	Miſty	S.W.b.W	29 4	
22.	12	Rain			
	9	Fair	S W.b.S.	29 50	0 43
	6	Fair	S.b.W.o	29 50	
23.	12	Cool	S. 1.	29 48	
	9	Day	S o.	29 48	
	6	Fair Then.	S. 1.	29 50	
24.	12	great Sh. with	W&N&	29 56	
	9	Hail.	S.	29 60	1 02
	6	Fair	W. o.	29 65	
25.	12	Pleaſant	N.W.1.	29 7	
	9	Day	W.S.W.o	29 77	
	6	Fair		29 76	
26.	12	Cloudy	W.b.S.o	29 76	
	9	Miſling		29 69	
	6	Cloudy	S.b.W.o	29 63	
27.	12	and	S.E.S.b.W	29 6	
	9	Cool.	E.b.N.1	29 60	
	6		N.N.E2	29 58	
28.	12	The ſame	E.b.N.2	29 62	
	9			29 69	
	6	Fair	N. 1.	29 70	
29.	12	Cool	N. 2.	29 76	
	9	Day		29 90	
	6		N.b.W.o.	29 77	
30.	12	The ſame.	W.b.N.1.	30 00	
	9			30 00	
	6	Cloudy	S.b.E.1.	29 90	0 20
31.	12	Warmer	S.S.E.1.	29 86	
	9	Rain	S. 1.	29 79	
				Total	6 09

JUNE. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.	D.	h.	Weather.	Winds	Barom.	Rain.
	6	Fair		29 66			6	Cloudy	N.	29 90	
1.	12	Hot	S. o.			17.	12	Fair	W. 1.	29 92	
	9	Rain		29 56			9	Sultry	W. o.	29 94	
	6	Rain	S. o.	29 42			6	Very	W.b.S.o	29 98	
2.	12	Shine	S. 1.	29 29	0 44	18.	12	Drough	W.b.S.1	30 00	
	9	Rain	S. 1	29 10			9	ty.	S. W. o.	30 00	
	6	Fair	S.b.W. o	29 08	0 79		6	Hot	SWbW 2,	29 93	
3.	12		S. 1	29 04		19.	12		W.b.E.1	29 91	0 22
	9	Showers	S. 1	29 02	0 37		9	Rain	N. E. o.	29 93	
	6		S. W. 2	29 18			6	Cloudy	N.b.E.o.	29 92	
4.	12	Cloudy		29 38		20.	12			29 92	
	9		S. 1	29 58			9	Cooler.	N. 1	29 96	
	6	Cloudy		29 72			6	Cloudy	N. o	30 00	
5.	12	Sultry	S. b. W. 1	29 83		21.	12	Much			
	9	Hot.		29 85			9	Cooler	N.E.1	30 02	
	6	Thun.	E. b. S.	29 85			6		N. o	30 01	
6.	12	Rain	E.o	29 82	1 13	22.	12	Fair	E. 1.		
	9	Thun.		29 74			9		N.E.b.N.o	29 90	
	6	Fog	S.b.W.	29 70	0 02		6	Cloudy	N. o.	29 80	
7.	12	Fair	S: W: 1	29 71		23.	12	Rain	E. 1	29 79	
	9	Hot	S.W.b.W.	29 72			9	Fair		29 79	
	6	Fair	S.W.b.W.	29 70			6	Great	N.E.b.E.1	29 77	
8.	12					24.	12	Drought	E.1	29 78	0 10
	9	Cloudy	S: o	29 56			9			29 78	
	6		S:b:E:o:	29 50			6	Cloudy	N.E.b.E.o.	29 74	
9.	12	Fair	S: 1	29 48		25.	12	Dry	N:E:1.	29 73	
	9	Rain	S: o:	29 51			9		E 1	29 71	
	6		S:b:E:o:	29 60			6	Sultry		29 71	
10.	12	Fair	S:b: W:1	29 68	0 01	26.	12		E. o	29 71	0 05
	9		S:o	29 75			9	Dry		29 73	
	6		S:	29 75			6	Miſt	E. o	29 74	
11.	12	Fair	S:			27.	12	Rain	E. b. S.	29 73	0 29
	9		E: o	29 65			9	Thun.	S. o	29 74	
	6	Cloudy	N:W:1:	29 60			6	Miſt		29 81	
12.	12	Fair	N.W.b.W.	29 55		28.	12	Hot and	S. 1.	29 83	
	9		N:W:o:	29 49			9	Dry		29 86	
	6		W: o:	29 40			6	Dry	E. o	29 85	
13.	12	Fair	S: W: o:	29 34		29.	12	Burning	E. 1.	29 85	
	9		S: W: o:	29 28			9	Day	S. o	29 87	
	6	Fair					6	Fair	S. W .o.	29 88	0 97
14.	12				0 02	30.	12			29 88	
	9	Rain	E: o:	29 38			9	Rain	S 1.	29 08	0 31
	6	Miſty	E: o:	29 45							
15.	12	Fair									
	9	Hot	N.b.W. 4	29 64							
	6			29 78						Total	4 91
16.	12	Cloudy	N: 1:		0 01						
	9			29 90							

JULY 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
	6	Rain	S. S. W.	29 75	
1.	12		S. W. 1.	29 72	
	9	Fair	S. W. o	29 70	0 24
	6		S W. o.	29 67	
2.	12	The ſame.			
	9		S. W. 1.	29 59	0 22
	6		W.bN.1	29 64	
3.	12	Fair		29 75	
	9		W. o	29 84	
	6	Cloudy	S. o.	29 85	
4.	12	Fair	S. W. 1.	29 85	
	9	Hot	S. W.	29 85	
	6	Fair	W. o.	29 87	
5.	12	Cool			
	9	Breezes	W. 1.	29 99	
	6	Hot	W. o.	29 95	
6.	12	Dry	W.b.S.1.	29 94	
	9	Day		29 90	
	6	Fair	W.b.No	29 86	
7.	12	Hot			
	9	Rain	W.b.S.o	29 79	0 12
	6	Miſling	S. W. 1.	29 68	
8.	12	Rain	S. W. 2.	29 60	
	9	Cloudy	S.S.W.1.	29 44	0 32
	6	Rain	S. W. 1.	29 42	0 75
9.	12	Cool	S. W. 1.	29 43	
	9	Fairer	W.N.W.o.	29 47	0 77
	6	Fair	W.b No	29 58	
10.	12	and	W. 1.	29 71	
	9	Cool	NW.b.W	29 83	
	6	Rain		29 85	
11.	12	Warmer	S. W. 1.	29 85	
	9			29 93	0 50
	6		S.W.bW	30 00	
12.	12				
	9				
	6	Fair			
13.	12	and			
	9	Hot	S. o	29 98	
	6	Fair	S. o.	29 90	
14.	12		S.b.W.1	29 88	
	9	Cloudy	S. W. 1.	29 84	
	6	Rain ,	Nb.W.1	29 84	
15.	12	Cloudy	W. 1.	29 85	0 48
	9	Fair	N. W. o.	29 90	
	6	Cooler	W. 1.	29 95	
16.	12	Rain	N.W.b	29 94	
	9	Thun.		29 92	0 42
	6	Fair	Wb.N.o	29 91	
17.	12	and	N. o.	29 93	
	9	Cool	N.N.W.o.	29 9[illegible]	
	6	Fair	N.W.1.	29 95	
18.	12	Cloudy			
	9	Rain	N. 1.	29 98	
	6	Miſling	N.	29 98	
19.	12		WN.W.1	30 00	0 62
	9	Cloudy			
	6				
20.	12	Showry			
	9		W.b.S.1	29 88	
	6	Rain	W.S.W.1	29 75	
21,	12	Fair	W.b.N.1.	29 [illegible]	
	9	Miſling	W. 1.	29 60	
	6	Miſty	S.W.b.W	29 4[illegible]	
22.	12	Rain			
	9	Fair	W.b.S.	29 50	0 43
	6	Fair	S.b.W.o	29 50	
23.	12	Cool	S. 1.	29 48	
	9	Day	S o.	29 48	
	6	Fair Then.	S. 1.	29 50	
24.	12	great Sh. with	W&N&	29 56	
	9	Hail.	S.	29 60	1 02
	6	Fair	W. o.	29 65	
25.	12	Pleaſant	N.W.1.	29 7[illegible]	
	9	Day	W.S.W.o	29 77	
	6	Fair		29 76	
26.	12	Cloudy	W.b.S.o	29 76	
	9	Miſling		29 69	
	6	Cloudy	S.b.W.o	29 63	
27.	12	and	S.E.S.b.W	29 6[illegible]	
	9	Cool.	E.b.N.1	29 60	
	6		N.N.E2	29 58	
28.	12	The ſame	E.b.N.2	29 62	
	9			29 69	
	6	Fair	N. 1.	29 70	
29.	12	Cool	N. 2.	29 76	
	9	Day		29 90	
	6		N.b.W.o.	29 77	
30.	12	The ſame.	W.b.N.1.	30 00	
	9			30 00	
	6	Cloudy	S.b.E.1.	29 90	0 20
31.	12	Warmer	S.S.E.1.	29 86	
	9	Rain	S. 1.	29 79	
				Total	6 09

JUNE. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.	D.	h.	Weather.	Winds	Barom.	Rain.
	6	Fair		29 66			6	Cloudy	N.	29 90	
1.	12	Hot	S. o.			17.	12	Fair	W. 1.	29 92	
	9	Rain		29 56			9	Sultry	W. o.	29 94	
	6	Rain	S. o.	19 42			6	Very	W. b. S. o	29 98	
2.	12	Shine	S. 1.	29 29	0 44	18.	12	Drough	W. b. S. 1	30 00	
	9	Rain	S. 1	29 10			9	ty.	S. W. o.	30 00	
	6	Fair	S. b. W. o	29 08	0 79		6	Hot	S W b W 2,	29 93	
3.	12		S. 1	29 04		19.	12		W. b. E. 1	29 91	0 22
	9	Showers	S. 1	29 02	0 37		9	Rain	N. E. o.	29 93	
	6		S. W. 2	29 18			6	Cloudy	N. b. E. o.	29 92	
4.	12	Cloudy		29 38		20.	12			29 92	
	9		S. 1	29 58			9	Cooler.	N. 1	29 96	
	6	Cloudy		29 72			6	Cloudy	N. o	30 00	
5.	12	Sultry	S. b. W. 1	29 83		21.	12	Much			
	9	Hot.		29 85			9	Cooler	N. E. 1	30 02	
	6	Thun.	E. b. S.	29 85			6		N. o	30 01	
6.	12	Rain	E. o	29 82	1 13	22.	12	Fair	E. 1.		
	9	Thun.		29 74			9		N. E. b. N. o	29 90	
	6	Fog	S. b. W.	29 70	0 02		6	Cloudy	N. o.	29 80	
7.	12	Fair	S: W: 1	29 71		23.	12	Rain	E. 1	29 79	
	9	Hot	S. W. b. W.	29 72			9	Fair		29 79	
	6	Fair	S. W. b. W.	29 70			6	Great	N. E. b. E. 1	29 77	
8.	12					24.	12	Drought	E. 1	29 78	0 10
	9	Cloudy	S: o	29 56			9			29 78	
	6		S: b: E: o:	29 50			6	Cloudy	N. E. b. E. o.	29 74	
9.	12	Fair	S: 1	29 48		25.	12	Dry	N: E: 1.	29 73	
	9	Rain	S: o:	29 51			9		E 1	29 71	
	6		S: b: E: o:	29 60			6	Sultry		29 71	
10.	12	Fair	S: b: W: 1	29 68	0 01	26.	12		E. o	29 71	0 05
	9		S: o	29 75			9	Dry		29 73	
	6		S:	29 75			6	Miſt	E. o	29 74	
11.	12	Fair	S:			27.	12	Rain	E. b. S.	29 73	0 29
	9		E: o	29 65			9	Thun.	S. o	29 74	
	6	Cloudy	N: W: 1:	29 60			6	Miſt		29 81	
12.	12	Fair	N. W. b. W.	29 55		28.	12	Hot and	S. 1.	29 83	
	9		N: W: o:	29 49			9	Dry		29 86	
	6		W: o:	29 40			6	Dry	E. o	29 85	
13.	12	Fair	S: W: o:	29 34		29.	12	Burning	E. 1.	29 85	
	9		S: W: o:	29 28			9	Day	S. o	29 87	
	6	Fair					6	Fair	S. W. o.	29 88	0 97
14.	12				0 02	30.	12			29 88	
	9	Rain	E: o:	29 38			9	Rain	S 1.	29 08	0 3
	6	Miſty	E: o:	29 45							
15.	12	Fair									
	9	Hot	N. b. W. 4	29 64							
	6			29 78						Total	4 9
16.	12	Cloudy	N: 1:		0 01						
	9			29 90							

JULY 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
1.	6	Rain	S. S. W.	29 75	
	12		S. W. 1.	29 72	
	9	Fair	S. W. o	29 70	0 24
2.	6		S W. o.	29 67	
	12	The ſame.			
	9		S. W. 1.	29 59	0 22
3.	6		W.bN.1	29 64	
	12	Fair		29 75	
	9		W. o	29 84	
4.	6	Cloudy	S. o.	29 85	
	12	Fair	S. W. 1.	29 85	
	9	Hot	S. W.	29 85	
5.	6	Fair	W. o.	29 87	
	12	Cool			
	9	Breezes	W. 1.	29 99	
6.	6	Hot	W. o.	29 95	
	12	Dry	W.b.S.1.	29 94	
	9	Day		29 90	
7.	6	Fair	W.b.No	29 86	
	12	Hot			
	9	Rain	W.b.S.o	29 79	0 12
8.	6	Miſling	S. W. 1.	29 68	
	12	Rain	S. W. 2.	29 60	
	9	Cloudy	S.S.W.1.	29 44	0 32
9.	6	Rain	S. W. 1.	29 42	0 75
	12	Cool	S. W. 1.	29 43	
	9	Fairer	W.N.W.o.	29 47	0 77
10.	6	Fair	W.b No	29 58	
	12	and	W. 1.	29 71	
	9	Cool	NW.b.W	29 83	
11.	6	Rain		29 85	
	12	Warmer	S. W. 1.	29 85	
	9			29 93	0 50
12.	6		S.W.bW	30 00	
	12				
	9				
13.	6	Fair			
	12	and			
	9	Hot	S. o	29 98	
14.	6	Fair	S. o.	29 90	
	12		S.b.W.1	29 88	
	9	Cloudy	S. W. 1.	29 84	
15.	6	Rain	Nb.W.1	29 84	
	12	Cloudy	W. 1.	29 85	0 48
	9	Fair	N. W. o.	29 90	
16.	6	Cooler	W. 1.	29 95	
	12	Rain	N.W.b.	29 94	
	9	Thun.		29 92	0 42
17.	6	Fair	Wb.N.o	29 91	
	12	and	N. o.	29 93	
	9	Cool	N.N.W.o.	29 93	
18.	6	Fair	N.W.1.	29 95	
	12	Cloudy			
	9	Rain	N. 1.	29 98	
19.	6	Miſling	N.	29 98	
	12		WN.W.1	30 00	0 62
	9	Cloudy			
20.	6				
	12	Showry			
	9		W.b.S.1	29 88	
21.	6	Rain	W.S.W.1	29 75	
	12	Fair	W.b.N.1.	29 11	
	9	Miſling	W. 1.	29 60	
22.	6	Miſty	S.W.b.W	29 45	
	12	Rain			
	9	Fair	W.b.S.	29 50	0 43
23.	6	Fair	S.b.W.o	29 50	
	12	Cool	S. 1.	29 48	
	9	Day	S. o.	29 48	
24.	6	FairThun.	S. 1.	29 50	
	12	great Sh. with	W&N&	29 56	
	9	Hail.	S.	29 60	1 02
25.	6	Fair	W. o.	29 65	
	12	Pleaſant	N.W.1.	29 72	
	9	Day	W.S.W.o	29 77	
26.	6	Fair		29 76	
	12	Cloudy	W.b.S.o	29 76	
	9	Miſling		29 69	
27.	6	Cloudy	S.b.W.o	29 63	
	12	and	S.E.S.b.W	29 60	
	9	Cool.	E.b.N.1	29 60	
28.	6		N.N.E2	29 58	
	12	The ſame	E.b.N.2	29 62	
	9			29 69	
29.	6	Fair	N. 1.	29 70	
	12	Cool	N. 2.	29 76	
	9	Day		29 90	
30.	6		N.b.W.o.	29 77	
	12	The ſame.	W.b.N.1.	30 00	
	9			30 00	
31.	6	Cloudy	S.b.E.1.	29 90	0 26
	12	Warmer	S.S.E.1.	29 86	
	9	Rain	S. 1.	29 79	
				Total	6 09

AUGUST. 1697.

D.	h.	Weather.	Winds.	Barom.	Rain.
1.	6	Cloudy	S.b.E.1.	29 73	
	12	Cloudy	S.b.E.2	29 72	
	9	Rain	S.b.E.2.	29 65	
2.	6	Fair	S.b.E.o.	29 63	0 51
	12	Showers	W.b.S.1	29 65	
	9	Fair		29 68	0 40
3.	6	Rain	S.b.E,2.	29 69	
	12	Cloudy	W. 3.	29 71	
	9	Fair		29 78	0 05
4.	6	Rain	S.W.b.S.1	29 69	
	12		S.b.W2.	29 65	
	9	Fairer	W. 1	29 60	1 00
5.	6	Rain			
	12		S. W. 2.	29 50	
	9	Fairer.	S. W. 1.	29 49	0 79
6.	6	The	S.b.W.o.	29 47	
	12	ſame.	S. 1.	29 48	
	9			29 49	0 22
7.	6	Cloudy	S.b,E.o.	29 51	
	12	Rain	E.b.N.1	29 55	
	9	Fairer	E.N.E.1	29 58	0 07
8.	6		N. 2.	29 50	
	12	Rain	N. 1.	29 48	4 00
	9	both	N. 2.	29 35	0 91
9.	6		W. 2.	29 37	
	12	Days	W.b.S.1.	29 42	0 50
	9			29 48	2 20
10.	6	Cloudy	W. 1.	29 60	0 39
	12	Rain	N. W. 2	29 66	
	9	Fairer	W. 1.	29 75	0 07
11.	6	Fair	W. o.	29 77	
	12	Pleaſant	W. 1.	29 80	
	9	Day	W.N.W.1.	29 82	
12.	6	Cloudy	W.b.No	29 82	
	12		W.bN.o	29 82	
	9	Fair	N. o.	29 85	
13.	6	Miſt	N. o.	29 88	
	12	Cloudy	W.b.S.1	29 89	
	9	Rain	S.b.W.1	29 83	0 33
14.	6	Cloudy	S. W. 2.	29 73	
	12		W. 2.	29 83	
	9	Fair	W. 2.	29 88	
15.	6	Cloudy	S. W. 1.	29 84	
	12	Little	W.b.S.2	29 81	
	9	Rain	S.W.b.W1	29 75	
16.	6	Cloudy		29 70	
	12	Fair	S. 1.	29 62	
	9	Cloudy		29 53	
17.	6		S. o.	29 48	
	12				
	9				
18.	6				
	12				
	9				
19.	6				
	12				
	9				
20.	6	Fair gr. Storm	S.b.W.2.		
	12	Thunder			
	9	Rain.		29 60	1 88
21.	6	Cloudy		29 60	
	12	Rain	S. 1.	29 60	
	9	Cloudy		29 61	0 13
22.	6	Cloudy	W.b.S.o	29 74	
	12	Miſling	W 1.	29 84	
	9	Fair	W.	29 90	
23.	6	Fair	W.b.S.o.	29 92	
	12		W.b.S.2	29 88	
	9	Cloudy	S. W. 2	29 84	
24.	6	Fair		29 82	
	12		S. W. 1		
	9	Sultry		29 78	
25.	6	Cloudy	S.W.b.S.1.	29 70	
	12		S.W.b.S.2.	29 67	
	9	Fair	S.b.W.2.	29 54	
26.	6	Rain	S. 3.	29 29	
	12		W.b.S.3	29 31	
	9	Fair		29 54	0 53
27.	6		S. W. 1.	29 81	
	12	Fair	W.b.S.2.	29 93	
	9			29 98	
28.	6		S.S.W.o	29 94	
	12	Fair	S.S.W.2	29 94	
	9			29 90	
29.	6	Cloudy	S. W. o.	29 95	
	12	Sultry	E. o.	29 99	
	9	VeryCl.		30 03	
30.	6		N. E. o.	30 03	
	12	Fair			
	9				
31.	6	Fair			
	12	and			
	9	Shar Air		30 01	
				Total	13 98

SEPTEMBER. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	6	Fair	E.b.N.1	29	98		
	12		N.E.2	30	00		
	9	Cool		30	98		
2.	6		NE.N3.	29	93		
	12	The	N.E.2	29	92		
	9	ſame		29	90		
3.	6	Hot Sun	E.b.N.0	29	88		
	12	but	E.1.	29	89		
	9	cool Air	E.	29	89		
4.	6	Fair	E.0.	29	84		
	12	warmer	E.2.	29	84		
	9	Air.		29	80		
5.	6	Fair	E.1.	29	78		
	12		E.0.	29	80		
	9	Hot		29	83		
6.	6	Miſt	E.0.	29	83		
	12	Fair	S.b.E.0	29	86		
	9	Hot		29	87		
7.	6		S. 0	29	85		
	12	The	E.2.	29	83		
	9	ſame	E.0.	29	80		
8.	6		E.0.	29	73		
	12	The					
	9	ſame		29	70		
9.	6	Fair	E.b.N.1	29	68		
	12	Cooler	E.b.N.2	29	66		
	9			29	56		
10.	6	Cloudy	E.1.	29	43		
	12		S.2.	29	39		
	9	Rain.		29	40	0	10
11.	6		S.b.E.0	29	38		
	12	Showers	W.S.W.1.	29	40		
	9			29	60	1	59
12.	6	Fair	S.0.	29	76	0	07
	12		S.b.W.2	29	77		
	9	Cloudy		29	70		
13.	6	Rain	S.2.	29	49		
	12		S.3.	29	38		
	9	Fair		29	63	1	54
14.	6		S.0.	29	67		
	12	Rain.	S.2.	29	59		
	9		S.4.	29	32		
15	6	Fair	S.W.1.	29	46		
	12			29	30		
	9	Rain	3	29	30		
16.	6	Fair	S.W.4	29	28		
	12	Cool	W.b.S.6	29	32		
	9	Cloudy	2	29	34		
17.	6	Fair	W.1.	29	45		
	12	Cool					
	9		0	29	75		
18.	6		E.b.S.0.	29	55		
	12	Rain	S.S.W.2.	29	34	3	19
	9		S.W.2.	29	10	1	69
19.	6	Fair	W.b.N.0	29	38		
	12	Cloudy	S.W.1.	29	50		
	9	Rain	S.1.	29	32	0	56
20.	6	Rain	S.W.3.	29	05		
	12		W.S.W.3.	29	02		
	9	Fair	3.	29	21	0	14
21.	6	Cloudy	W.S.W.3.	29	35		
	12	Rain	S.1.	29	31		
	9	Cold	S.W.1	28	98		
22.	6	Fair	S.W.2.	29	24		
	12.	Shower					
	9			29	38	0	09
23.	6	Fair	S.W.1.	29	51		
	12						
	9	Rain	W.N.W	29	74		
24.	6		S.W.0.	29	87		
	12	Fair	N.				
	9	Rain		29	87		
25.	6		E.0.	29	66	0	08
	12	Cloudy	S.E.2.				
	9	Miſling.		29	38	0	30
26.	6	Fair	N.E.0.	29	38		
	12	Rain	E.1.	29	40		
	9	Cold		29	30	0	24
27.	6	Fair	E.0.	29	27		
	12	Cloudy	E.b.N.1	29	25		
	9	Rain		29	30	0	8
28.	6	Fair	N.E.1.	29	38		
	12	Cold	N.b.E.3				
	9	Day		29	56		
29.	6	Hoar-F.	N.b.W.1	29	65		
	12		N.b.W.1	29	70		
	9	Fair.		29	78		
30.	6	Ice	N.b.W.0	9	80		
	12	Fair		29	82		
	9	Cloudy		29	83	0	22
				Total.		10	47

DECEMBER. 1697.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Hard	W. b.n.o	29	86		
1.	12	Froſt &	W.b.n 2	29	87		
	9	Fair		29	89		
	8		N. 1.	29	90		
2.	12	Same.	N. o.	29	94		
	9			29	99		
	8		N. o.	30	05		
3.	12	Same	NN.E.o	30	08		
	9			30	06		
	8	Cloudy	N. W. 1	29	98		
4.	12	Snow.	w:n:w:1.	29	89		
	9	half inch		29	96		
	8	Cloudy	N:b:E.2.	30	00		
5.	12	Fair.	N:N:E1	30	06		
	9			30	09		
	8	Snow	N.w.b.N.3	29	98		
6.	12	Fair	N.w.b.N.1	29	99		
	9	Sn.1.In:		30	00		
	8	Snow 6.	N. W. o.	29	93		
7.	12	Snow 8.	S. o.	29	71		
	9	Inches.		29	68		
	8			29	84		
8.	12	Fair	E. o.	29	87		
	9			29	85		
	8	Snow		29	64		
9.	12	Sleet	S.b.E.1.	29	55		
	9	Thaw		29	42		
	8	Froſt.	E.N.E.o	29	55		
10.	12	Thaw	E. o.	29	57	3	62
	9	Snow	2.	29	46		
	8	Rain	E.S.E.2.	29	09	2	76
11.	12	warm	S.b.W.1.	29	10		
	9	Thaw		29	24	0	90
	8	Thaw	S.b.E.2.	29	14		
12.	12		S. 2.	29	04		
	9	Rain		29	11	0	42
	8	Fair	S.W. 3.	29	33		
13.	12	Warm	w.s.w.3.	29	50		
	9	Pleaſant	S. W. 1.	29	61		
	8	Cloudy	S. W. 1.	29	68		
14.	12	warm	w.s.w.1.	29	67		
	9	Day	w.s.w.o.	29	65		
	8	Miſty	E. 1.	29	64		
15.	12	warm	E.b.N.o	29	64		
	9	Day		29	65		
	8	Froſt					
16.	12		E.b.N.1	29	58		
	9	Fair		29	59		
	8	Froſt		29	57		
17.	12	Cloudy	E. o	29	56		
	9	Fairer.		29	62		
	8			29	64		
18.	12	Miſt.	E. o				
	9			29	72		
	8	Cloudy		29	70		
19.	12	warm	E. 1.	29	68		
	9	Day.		29	63		
	8	Fog	E. 2.	29	50		
20.	12	Cloudy					
	9	Colder.		29	44		
	8	Rain		29	45		2
21.	12	Cloudy	E. 1.	29	51		
	9	Cold		29	62	0	17
	8	Rain.		29	75	0	0
22.	12	Cloudy	E. 1.				
	9	Fair		29	90		
	8		S b.E.1.	29	83		
23.	12	Cloudy	S. 1.	29	76		
	9			29	64		
	8		S.b.W.2.	29	52	0	46
24.	12	Rain	S. 2.	29	46		
	9	Stormy	2.	29	34	0	56
	8	Fair	W. 3.	29	25		
25.	12	and	S. W.2.	29	40		
	9	warm		29	61	0	03
	8	Cloudy	w.s.w.2.	29	62		
26.	12	Fair	W.b.s.2.	29	70		
	9	warm	3.	29	87		
	8	Cloudy	w.s.w. 2.	29	90		
27.	12						
	9	Miſling		29	82		
	8	Cloudy	S.b.w.o.	29	66		
28.	12	Rain	W.b.S.3	29	56		
	9	Fair.		29	75	0	0
	8	Fair	W. 2.	29	90		
29.	12	Cloudy	w.b.N.2	29	97		
	9	Rain	o.	29	97		
	8	Fair	N. E. 1.	30	10	0	0
30.	12	Cloudy	N. E. 1.	30	15		
	9	Fair		30	20		
	8	Froſt	E. o.	30	18	0	0
31.	12	Cloudy	E.b.S.o.	30	15		
	9	Fair		30	08		
				Total		9	3

In this Table, the Quantity of Rain, which fell through a Tunnel of 12 Inches Diameter, is ſet down in Pounds and Centeſimals; and I meaſured it with a Cylindrical Glaſs, after Mr. *Townley*'s Method.

Where only one ſort of Weather is nóted upon one Day, that was the Weather of all the Day; eſpecially if the Barometer be noted 3 times. The ſame obſerve alſo in the Column of Winds.

In the Column of Winds, 0, ſignifies a Calm; 1, 2, 3, &c. denotes the ſtrength of the Wind; wherefore, 5, or 6, is a little Storm; 7, or 8, a great Storm.

I have noted in the Column of Weather, the Depth of the Snow upon the Ground.

The whole Quantity of Rain that fell through my Funnel laſt year, was 77,60 *l.* which is leſs than fell from the Beginning of *March* (at which time I began my Rain Obſervations) till the End of *December*, 1696. In which 10 Months there fell here, at *Upminſter* almoſt 115 *l.* and at *Townley* in *Lancaſhire* (according to Mr. *Townley*'s Obſervations) above 172 *l.* and in the whole year at *Townley* 203,76 *l.*

The Weather 1698. *at* Upminſter, *by Mr.* Wil. Derham, n. 219. p. 45.

XXIV. The Quantity of Rain which fell through my Tunnel this year 1698. was 122,32 Pounds. I find Foggy Weather makes the *Mercury* riſe, as well as the North Wind; as may be Obſerved in the following Table, in the Month of *December*, at which time the Mercury as very high, although the Wind was in the Southerly Points. I ſubmit it, whether the Cauſe be not the Increaſe of the Weight of the Atmoſphere, by an Addition of thoſe Vapours of which the Fog conſiſts, which are manifeſtly as heavy as the Air, becauſe they ſwim in it without Aſcending? Theſe filling up many of the Vacuities of the Air, without extruding much the parts of Air (as I judge Clouds do) do add conſiderably to the Weight of the Atmoſphere, and ſo cauſe the Mercury to Aſcend.

The greateſt Range I have ever obſerved the Mercury to have, is no more than 2,12 Inches; it being here never higher than 30,40 nor lower than 28,28 Inches. The loweſt it ever was, within my Obſervations, was *Jan.* 24. about 2 of the Clock in the Afternoon; about which Hour Mr. *Townley* obſerved his Barometer to fall to 27,80 Inches, which, he ſays, was remarkably low.

JANUARY. 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.	D.	h.	Weather.	Winds	Barom.	Rain.
	8	Froſt	S. E. 0.	29 95			8	Snow	N.W.0.	29 57	
1.	12	Fair	S:b:E:1:	29 90		17.	12	with the former 5.	E.1.N.E 2.	29 60	
	9	HardFr.	0	29 82			9	Inches	N.b.E.1	29 65	
	8	Cloudy	S:b:E:1:	29 63			8	Little	N. 1	29 68	
2.	12	Froſt.	S:b:E:2:	29 48		18.	12	Snow fell	N. 2	29 69	
	9	Snow	0	29 26			9	Cold	N.b.E.2	29 71	
	8	Snow 3.	W:b:S:0	29 15			8	Snow 3	E. 0.	29 62	
3.	12	1 Inch				19.	12	Inch more	E. b. S.2	29 59	
	9	Rain		28 94	0 55		9	Cloudy all Day.	2	29 59	
	8	Rain	E: 0	28 80	0 99		8	Cloudy	E.b.N.3.	29 65	
4.	12	Sleet Snow 4.	E: 0:	28 88		20.	12	very	E:b:N:3	29 70	
	9	Cloudy.		29 18	2 98		9	Cold Day	2	29 84	
	8	Froſt	W. 0.	29 44	0 20		8	HardFr.	E.b.N.2	29 92	
5.	12	Fair	W.S.W.1	29 53		21.	12	& Cloudy	E.b.N.2	29 95	
	9	Cloudy		29 64	0 33		9	as before	1	29 95	
	8	Rain	E.1	29 49	0 20		8	Fairer	E:b:S:0:	29 82	
6.	12	Fair	E.b.N.1	29 50		22.	12	very	E 1	29 68	
	9	Cloudy		29 78	0 23		9	Cold	E. 3	29 30	
	8	Froſt	N:b:W.1	29 98			8	Snow 5	E:b:N:0	29 99	
7.	12	Fair	N. 1.	30 04		23.	12	Inches Cloudy	N. E. 1	29 00	
	9	Snow.re.		30 14			9	Snowy Day	2	29 07	
	8	Froſt	N.b.E.1	30 18			8	Snow 3	E.b.S.1	28 73	
8.	12	Showers	N.N.E.2	30 18		24.	12	Inches	S.E.2.	28 38 28 28	
	9	of Snow		30 16			9	Sleet Thaw	S. W. 1.	28 31	2.
	8	Cloudy	N. E. 2.	30 07			8	Thaw	S. 2	28 38	0
9.	12	Cold	N.E.b.N.2.	30 04		25.	12	Thaw Showers	S. 1	28 40	
	9	Day		30 00			9	of Rain		28 56	0
	8	Froſt	N.E.1.	29 90			8	Rain	S. 0.	28 72	0
10.	12	Cloudy		29 89		26.	12	Thaw with			
	9	Day					9	Showers		28 94	0
	8	Same	N. E. 0.				8	Fairer	S.b.W.0	29 93	0
11.	12	but leſs		29 79		27.	12		S.b.E.1	29 00	
	9	Cold.		29 73			9	Rain	[illegible]	28 88	0
	8	Cloudy	N:E:0:	29 61			8	Froſt &	[illegible]	28 98	0
12.	12	Fairer	S.0.W:1	29 53		28.	12	Fair	S.S.W.1	28 8[illegible]	
	9	Fair		29 30			9	Rain	S.E.b.S.1	28 68	0
	8	Froſt	S. 0.	29 21			8	Same with	S. W. 2	28 19	
13.	12	Fair		29 18		29.	12	Bluſtring	S.S.E.4.	28 67	
	9	Snow	W: 0:	29 16			9	Snow	4	28 53	0
	8	Snow 3.	N.N.W.1.	29 23			8	Froſt	W.b.S.1	28 92	0
14.	12	Cloudy	N.N.W.1	29 29		30.	12	Fair Plea-	W. 2	29 06	
	9	Fair	N: 1:	29 40			9	ſant Day		29 51	
	8	Hard	Nb:W:1	29 52			8	Fair	N. W. 0	29 70	0
15	12	Froſt	N: 1.	29 65		31.	12	Wet After-	S. W. 1.	29 71	
	9	Fair	N. 0:	29 79			9	noon.		29 58	
	8		Nb. W.0	29 77						Total	10
16.	12	Same									
	9		N. 0.	9 74							

FEBRUARY, 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	7	Miſling	S. W. 2	29	48		
	12						
	9	Warm					
2.	7	Fair					
	12						
	9	Miſling	4	29	11		
3.	7	Fair	W.b.S.3	28	97	0	34
	12	Cloudy	W.S.W4	29	06		
	9	Fair	1	29	26		
4.	7	Froſt	S. W. 0	29	36		
	12	Fair and	W. 1.	29	4		
	9	Pleaſant		29	62		
5.	7		N. 1	29	86		
	12	The ſame	N. E. 1				
	9			30	06		
6.	7	Froſt	E.b.N.1	30	08		
	12	and	E. 1	30	08		
	9	Cloudy					
7.	7	Froſt	E.b.N.0	30	01		
	12	Fair and	W. 1.	30	01		
	9	Warm		29	96		
8.	7	Froſt	E.b.N.0	29	88		
	12	Fair	E. 0	29	89		
	9	Cooler	0	29	89		
9.	7		E.b.N.0	29	83		
	12	Same	E.N.E.1.	29	84		
	9			29	91		
10	7	Cloudy	N. E. 1	29	99		
	12	Cold	N. E. 2	30	02		
	9	Fair		30	07		
11.	7	Froſt	N. E 1	30	08		
	12	and	E.b.N.2		08		
	9	Fair	N. E. 1	30	11		
12.	7	Fair Cl.	E.N.E.1	29	90		
	12	with	N. E. 2	29	87		
	9	Froſt	2	29	85		
13.	7	FroſtCl	E.N.E 3	29	84		
	12	and very	N. E. 4	29	86		
	9	Cold	N. E. 3	29	94		
14.	7		N.b.W 0	29	83		
	12	Snow	N.W.bN2	29	86		
	9		4	29	86		
15.	7	Snow	N. E 3.	29	86		
	12	halfInch	N.E.b.N.4	29	81		
	9	very cold	2	29	72		
16.	7	Sn. 1. Inch	N.E b.E.	29	63		
	12	very	E.N.E.3	29	56		
	9	Cold		29	53		
17.	7	Cloudy	E.b N. 2	29	42		
	12	Sleet, leſs	E.b.N.1.	29	8		
	9	Cold		29	43		
18.	7	Fair or	E 0	29	60	0	14
	12	Cloudy	E.b.N.1	29	50		
	9	Thaw Rain		29	52	0	16
19.	7	Cloudy	E. 2	29	51	0	15
	12	Rain	E.b N. 2	29	55		
	9	Cloudy		29	68	0	28
20.	7	Fairer	E.b.N.2	29	68		
	12	Colder	E.b.N.3	29	71		
	9	Freezing		29	75		
21.	7	Froſt	E.b.N.1	29	81		
	12	Fair and	E.b.N.2	29	84		
	9	Pleaſant	0	29	84		
22.	7		N. E 0	29	85		
	12	Same	E.b.N1.	29	88		
	9			29	90		
23.	7	Froſt &	E.b.N.0	29	94		
	12	Fair	E. 1.	29	97		
	9	Cl. Warm		30	00		
24.	7	Cloudy	E. 0	29	96		
	12	Fr.Cold	E. 1	29	97		
	9	Fair		29	97		
25.	7	Miſt Fr.	E.b N.0	29	95		
	12	Fair and	E. 0	29	99		
	9	Warmer		29	93		
26.	7	Froſt	E. 0	29	88		
	12		E. 1	29	88		
	9	Cloudy		29	88		
27.	7	Froſt and Fair	E. 0	29	79		
	12	Warmer	E. 1.	29	78		
	9	Cloudy	S. W.	29	70		
28.	7	Rain	Sw.b.S.1	29	60	0	24
	12	Fair and					
	9	Thaw					
				Total		1	31

MARCH 1698.

D.	h.	Weather.	Winds.	Barom.	Rain.
1.	6	Fair			
	12	Warm&			
	9	Pleaſant		29 60	
2.	6	Fair	S. S. E. 0.	29 39	
	12	Warm	S.b.W.1.	29 38	
	9	Rain	NW.bW.1	29 60	0 32
3.	6		N. W. 1.	29 74	
	12	Cloudy	N. 2.		
	9			30 00	
4.	6	Cloudy	N. 1.	30 05	
	12	Colder	N.b.E.2	30 10	
	9	Day.		30 19	
5.	6	Cloudy	N. E 1	30 16	
	12	Cold	E.b. N 2	30 10	
	9	Winds		30 05	
6.	6	Froſt	N. E. 0	29 92	
	12		N. E. 1.	29 90	
	9	Fair		29 83	
7.	6	Froſt	N. E. 2	29 72	
	12	Cloudy	N.E.bE3	29 74	
	9	Cold		29 74	
8.	6	Froſt	N. E 0.	29 70	
	12	Cloudy	N.E.b.E.[illegible]	29 71	
	9	Warmer		29 80	
9.	6	Fr. and Fair	S.E.b.E.0.	29 81	
	12	and Sharp Snow,	S. 1.	29 76	
	9	Rain		29 68	
10.	6	Cloudy	S. 0.	29 51	1 49
	12	Showers	W. 2.	29 54	
	9	Fair.		29 71	0 10
11.	6	Showers	S. 1.	29 63	
	12		S.S.W.2	29 42	
	9	Fairer	S. W. 2	29 61	0 70
12.	6	Rain	S.S.W. 3	29 42	0 26
	12	Warm	S. W. 5.	29 35	
	9	Showers	S. W. 3.	29 39	0 98
13.	6		SWbW2.	29 63	
	12	Fair	SWbW2.	29 69	
	9		WSW. 2	29 78	
14.	6	Warm	SWbW2.	29 74	
	12	Cloudy	SWbW4.	29 74	
	9	Day		29 84	
15.	6		S. W. 2	29 87	
	12	Same	S. W. 3	29 89	
	9		W.b.S.2.	29 95	
16.	6		W.S.W2	30 02	
	12	Same			
	9			30 03	
17.	6		S. 1.	29 80	
	12	Same	S. W. 2	29 68	
	9	Rain	S.b.W. 3	29 43	
18.	6	Fairer	W.b.S.4.	29 24	0 23
	12	Hail and	W.b.S.7.	29 36	
	9	Cooler	1	29 50	0 05
19.	6	Hoar Fr.	S. W. 0.	29 60	
	12	Fair	W. 2.	29 74	
	9	Rain	0	29 78	
20.	6	Cloudy	WSbW2.	29 76	0 01
	12		S. W. 3.	29 78	
	9	Warmer		29 78	
21.	6		S.S.W.2.	29 68	
	12	Same	S. W. 3		
	9			29 58	
22.	6	Cloudy	S.S.W.1	29 59	
	12		W. 1.	29 73	
	9	Fair	N. W. 0	29 98	
23.	6	Froſt	N.b.W0	30 11	
	12	Fair and	S. 1.	30 14	
	9	Pleaſant	S. W. 0	30 14	
24.	6		S.b.E.0.	30 09	
	12	Same	E.b.S.1.	30 08	
	9			30 00	
25.	6	Froſt	E.b.N.0	29 90	
	12	Fair	E. 1.	29 88	
	9	Rain		29 83	
26.	6	Fair very	E. 0	29 77	0 38
	12	Warm	E. b. S. 1	29 77	
	9	Lightning		29 71	
27.	6	Miſty	S. W. 0	29 73	
	12	Fair	S. 1	29 75	
	9	Cloudy		29 66	
28.	6	Rain	S. 2	29 42	0 28
	12	Cloudy	S.b.W.4.	29 34	
	9	Cooler		29 46	0 05
29.	6	Fair	W.S. W. 1	29 63	
	12		W.b.S. 2	29 70	
	9	Showers		29 79	0 06
30.	6	Hoar	S. 0	29 70	
	12	Froſt	S. W. 3	29 59	
	9	Rain		29 46	0 34
31.	6	Rain	E b.N.0	29 36	2 52
	12	Rain	N. 2.	29 49	1 52
	9	Fairer		29 72	9 33
				Total	9 33

APRIL 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	6		S.b.E.o.	29	68		
	12	Rain	S.S.W.1	29	48		
	9			29	26	1	47
2.	6	Cloudy	W.S.w.2	29	27	0	11
	12		W.n:w3.	29	40		
	9	Fair		29	57		
3.	6	Hoar-F.	S. W. o.	29	62		
	12	Fair	W. 1.	29	71		
	9	Rain		29	83	0	26
4.	6		E.b.N.o	29	90	0	03
	12	Fair	N. E. 1.	29	95		
	9			30	00		
5.	6		N.N.E1	29	97		
	12	ſame					
	9						
6.	6						
	12	Cloudy					
	9			29	88		
7.	6	Fair	N.N.Eo	29	94		
	12		E. 2.	29	91		
	9	Cloudy		29	79		
8.	6		S.b.W.2	29	65		
	12	ſhowers	N. W. 2	29	71		
	9			29	83	0	22
9.	6	Hoar-F.	S. W. o.	29	83		
	12	Cloudy	S. W. 2.	29	82		
	9	Fair	S. o.	29	82		
10.	6		S.b:w.2.	29	75		
	12	Cloudy	S.S:W.2	29	67		
	9			29	64		
11.	6	Fair	S W. 1	29	66		
	12	with					
	9	ſhowers	W.b.S.2.	29	56	0	11
12.	6	Fair &	W.b.S.1.	29	60		
	12	Cool		29	68		
	9		S. o.	29	70		
13.	6	Cloudy	S. 1.	29	68		
	12	warm	S:s:w:1:	29	66		
	9	Rain	W:b:S:o	29	62		
14.	6		W.b.N1	29	68	0	14
	12	Fair.					
	9	ſhowers		29	80	0	06
15.	6	Cloudy	W:b:S.2.	29	50		
	12		w:n:w:4.	29	50		
	9	ſhowers	N.N.w3	29	73		
16.	6	Snow	N: W: 3	29	76		
	12		N. 5.	29	85		
	9	Cloudy	N. 2.	29	89	1	00
17.	6	Fair	N.b.w.2	29	87		
	12	and	N. 2	29	88		
	9	Cold	N.b.E.1	29	92		
18.	6		N.b.w.1	29	90		
	12						
	9						
19.	6	Cloudy					
	12	warmer	N. 1.	29	88		
	9	Rain.		29	90		
20.	6	Cloudy	W. 1	29	80	0	44
	12	Rain	W.S.w	29	68		
	9			29	42		
21.	6	Fair &	W. 2.	29	28	0	37
	12	Cold	W.b.n.2	29	30		
	9	Cloudy		29	26		
22.	6	Rain	N. 3	29	34	0	19
	12	Snow	N.n.w.3	29	43		
	9	Fair		29	44	0	03
23.	6	Ice very	E.S.E.1.	29	32		
	12	Cold	S. E. 2	29	29		
	9	Rain		29	28	0	58
24.	6	Miſling	E.b.S.o	29	31		
	12	warmer	E. 1.	29	46		
	9	Fair		29	68		
25.	6	ſhowers	S.W.1.	29	70		
	12		W. 2				
	9	Fair		29	83	0	42
26.	6	Fair.	W. 2	29	83		
	12	Hail	W. 3	29	80		
	9	ſhowers		29	63		
27.	6	Snow	W.b.S.2.	29	56	0	89
	12	Sleet	W. 3	29	56		
	9	Fairer		29	62	0	48
28.	6	ſhowers	N.W.1.	29	67	0	20
	12	of Hail	N.b.w.2	29	71		
	9	& Rain		29	83	0	31
29.	6	Cold	n.w.b.n1	29	84		
	12	ſhowers	N. W. 2	29	86		
	9			29	81	0	43
30.	6		N.n.w.1	29	78	0	09
	12	Rain.	N.n.E.2	29	78		
	9			29	80	0	25
				Total		8	08

MAY, 1698.

D.	h.	Weather.	Winds.	Barom.		Rain		D.	h.	Weather	Winds.	Barom.		Rain.	
1.	6		S. 1.	29	74	0	58	17.	6		E. 0.	29	66		
	12	Rain	N. W.1	29	73				12	Rain					
	9			29	75	0	73		9		E. 0.	29	63	0	54
2.	6		N. 2.	29	7	0	46	18.	6	Rain	Ne.b.e.0	29	59	0	43
	12	Fair	w.n.w.1.	29	75				12	warm,	S.E. 1.	29	56		
	9			29	72				9	Fair	S.S.E.0	29	53	0	05
3.	6	Fair	N. 0.	29	75			19.	6	Cloudy	E. 1.	29	48		
	12	Snow							12	Hot	E.b.E.2.	29	46		
	9	Ice							9	Fair	S. 0.	29	49		
4.	6	Fair						20.	6	Cloudy	S.e.b.e.1	29	49		
	12	Cold	N.b.E.2.						12	Cooler	S. 4.	29	50		
	9	Cloudy		29	71	0	22		9	Fair	S.b.W.2	29	62		
5.	6	Cold	W. 0.	29	7			21.	6	Showers	S.S.W.3	29	68		
	12	and	S. W. 1.	29	71				12		Sw.bw.5.	29	73		
	9	Fair	S.b.w.2	29	70				9	Fair		29	81	0	3
6.	6	Rain.	S. W. 1	29	66			22.	6	Showers	S.b.E.1,	29	72	0	02
	12	Warm							12	and	S.S.E.1	29	70		
	9	Fair	S.b. E.1	29	78	0	76		9	Cooler	Sw.b.s.3	29	66	0	9
7.	6	Cloudy	S.b.E.1.	29	78	0	13	23.	6	Rain	S.b.E.1.	29	48	0	7
	12		W.b.E.1	29	80				12	Cloudy	S.b.w.2.	29	47		
	9	Fair	S.S.E.0.	29	80				9	Fair	S.b.w.0.	29	46		
8.	6	Fair	N.b.w.1	29	80			24.	6		S. 2.	29	43		
	12	Warm	N.n.w.2	29	94				12	Showers					
	9	Day.	N. 0.	30	10				9		S W. 0.	29	46	0	4
9.	6		N.bw.1	30	11			25.	6						
	12	ſame	W.b.S.1	30	11				12	Fair					
	9			30	00				9						
10.	6	ſmall	W.b.n.0	29	82			26.	6	Rain					
	12	ſhowers	N. W.2	29	80				12						
	9		W.b.n3	29	81	0	08		9	Cool	N.NE.2	29	58	2	7
11.	6	Cloudy	N.Nw.3	29	82	0	03	27.	6	Cloudy	E.b.S.1.	29	67	0	2
	12	Cooler	N Nw.2	29	85				12	warmer	S. 1.	29	71		
	9	Rain	N.N.E0	29	82				9	Fair	E. 0.	29	78		
12.	6		N. E. 2.	29	69	0	51	28.	6	Fair	N. 1.	29	78		
	12	ſhowers							12	ſhowers	E.b.N.1	29	77		
	9		N.Nw.2	29	68	0	10		9	Rain	E. 1.	29	76	0	[illegible]
13.	6	Cloudy	nw.b.n.2	29	70			29.	6		N.b.E.1.	29	69	1	6
	12		N. 3.	29	70				12	Miſling	E.b.S.0.	29	74		
	9	Fair	N. 0.	29	74				9		S. 1.	29	76	0	2
14.	6		N. 0.	29	75			30.	6		S.b.W.1.	29	76		
	12	Fair	E. 2.	29	82				12	Fair					
	9			29	87				9		N.b.w.1	29	70		
15	6		N.E.1.	29	92			31.	6		N.wbn.1	29	68	0	9
	12	Fair	N.b.E.1	29	95				12	Fair	W.Nw.1	29	65		
	9		E.b.S.0.	29	94				9		W.S.w.0	29	62		
16.	6	Fair	E. 0.	29	87							Total.		12	9
	12	and													
	9	warm	E. 0.	29	73										

JUNE. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	6	Fair	W. 2.	29	60		
	12	and		29	60		
	9	Hot	S. o.	29	60		
2.	6	Fair	S.w.b.S.2	29	57		
	12		W. 3.	29	52		
	9	Rain	S. 1.	29	50	0	23
3.	6	Cloudy	S. 1.	29	51		
	12	Thund.	N. W.2	29	55		
	9		N:b:w:o	29	72	0	46
4.	6	Miſling	N.b.W.2	29	81		
	12	Fair &	N. 3.	29	90		
	9	Cool	E.S.E.o	29	99	0	02
5.	6	Fair.	E.b.S o	30	01		
	12	Cloudy	W. 2.	30	0		
	9	Fair	S. W. o.	30	04		
6.	6	Fair	S. W.o	30	06		
	12	and	S.S.W.1	30	07		
	9	Hotter	o	30	08		
7.	6	Fair	W.b.S 1	30	09		
	12	and	S.b.E.o.	30	09		
	9	Hot		30	10		
8.	6	Fair	E.b.N o	30	03		
	12	Hot	E.b.N.2	30 30	03 05		
	9	Cloudy	Ne.b.n3	30	08		
9.	6	Cloudy	N.N.E2	30	92		
	12	Fair	N.N.E3	30	01		
	9	Cloudy	N. E. 2.	29	95		
10.	6	Cloudy	N. E. 2.	29	86		
	12	Cooler		29	81		
	9	Rain	E. 1.	29	74	2	25
11.	6	Cloudy	N.b.E.o	29	68	0	17
	12	Cloſe	N.b.E.1	29	66		
	9	Day		29	62		
12.	6	Much	N.N.w1	29	57		
	12	Rain	N.N.w1	29	52		
	9		N.N:w1	29	47	3	92
13.	6		N. o.	29	42	0	91
	12	Miſling					
	9		W.b.S.1	29	52	0	38
14.	6		W.b.S.2	29	62	0	1
	12	Cloudy	S. W. 3.	29	67		
	9		S. W. 2.	29	70		
15.	6		S. W. 1	29			
	12						
	9						
16.	6						
	12						
	9						
17.	6	Fair					
	12						
	9	Cloudy	N. w. o.	30	05		
18.	6		N.W.o.	30	04		
	12	Fair	N.n.w.1	30	05		
	9		E. 1	30	08		
19.	6		E. o.	30	08		
	12	Fair	E.b.S.1.	30	08		
	9		E. o.	30	05		
20.	6	Fair.	E.b.S o	30	03		
	12		E.b S.o	30	00		
	9	Hot		29	92		
21.	6	Fair	E.b.S.o	29	87		
	12		S. w. 2.	29	86		
	9	Cloudy	W. o	29	86		
22.	6	Miſling	W.b.S.o	29	86		
	12		N.b.w. 1	29	89		
	9	Cloudy	E. 1	29	90		
23.	6	Fair	E. o	29	83		
	12	and					
	9	Hot	S.b. w. 1	29	73		
24.	6	Rain.	S.b.w.2	29	65		
	12	and	S. 3.	29	61		
	9	Cooler	S. 2.	29	58	0	08
25.	6	Fair	Sw.bw 3	29	62	0	19
	12	Rain	S.b.W.3	29	64		
	9	Fairer.	S. o	29	68	0	06
26.	6	Fair	W.S.w 1	29	76		
	12		W.b.S.1	29	78		
	9	Cloudy	W.b.S o	29	80		
27.	6		S. W. 1	29	78		
	12	Cloudy	W.s.w.3	29	75		
	9		W.b.S.2.	29	69		
28.	6			29	69		
	12	Rain					
	9						
29.	6						
	12	Fair					
	9		W. 1.	29	73		
30.	6	Cloudy	W.b.S.2	29	71		
	12	Miſling	W.S:w:1	29	74		
	9	Cloudy		29	78		
				Total		8	77

JULY. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	6		W.Nw1	29	78		
	12	Cloudy	W.b:S.1	29	78		
	9		W.S.wo	29	75		
2.	6	Cool	N. 1.	29	77		
	12	Rain	N.N.E2	29	83		
	9	Warmer	N. o.	29	88	0	23
3.	6	Fair	N. o.	29	88		
	12	and	S. W. 2.	29	86		
	9	Hot		29	8		
4.	6	Cloudy	S.w.b.s3	29	74		
	12	Miſling	S. w. 3.	29	67		
	9	Rain.	S. W. 3	29	61		
5.	6		S.b.w.2.	29	52	1	87
	12	Fairer	W.s.w.4	29	50		
	9	Rain	S. W. 3	29	56	0	05
6.	6	Cloudy	W.s.w. 1	29	66	0	05
	12	Hot	sw:b:w3	29	70		
	9	Fair	W.b.S.o	29	75		
7.	6	Fair	Sw.b:s:1	29	77		
	12	Rain		29	76		
	9	Fair	S. w. o	29	73		
8.	6	Miſty	S. w. o	29	73		
	12	very	w. s. w.1	29	75		
	9	Hot	S.b.E.o.	29	78		
9.	6	Cloudy	E.b.S.1.	29	79		
	12	Hot &	E. 1.	29	78		
	9	ſultry	E. o.	29	76		
10.	6		E. o.	29	73		
	12	ſame	E.b.S.1	29	72		
	9		E. o.	29	67		
11.	6	Thund. &	E.S.E.1.	29	59	2	83
	12	Rain, Rain	S.s.w. 1				
	9	Fairer	S.b.w.o.	29	50	0	84
12.	6	Cloudy	N.n.w.1	29	48		
	12		W. 2.	29	47		
	9	Rain	N. W. 3	29	47	4	49
13.	6	Cloudy	N.Nw.1	29	54	0	01
	12		Nw.bw2	29	61		
	9	Fair	Nw.bwo	29	62		
14.	6	Cloudy	s.w.b.w2	29	63		
	12	with ſome	S.w.b.w1	29	63		
	9	Fair	S.b.w. 2	29	58		
15.	6	Cloudy	S.b.w.3	29	48		
	12	Rain	S. 4.	29	43		
	9	Cloudy	S. 2	29	38	0	36
16.	6	Fair	S.W.3.	29	43		
	12	Cool	W.s.w.4	29	53		
	9	Rain		29	64	0	47
17.	6	Fair, Fair	S W. 1.	29	74	0	0
	12	Cloudy	S. 3.	29	77		
	9	Rain	S.b.W.2.	29	73		
18.	6	Miſling	Sw.b.w.3	29	51	0	9
	12	Rain	S. w. 3.	29	56		
	9	Fairer		29	75	1	1
19.	6		W.Sw.1.	29	83		
	12	Fair	w.b.N.2	29	87		
	9			29	87		
20.	6		WS.W.o	29	84		
	12	Hot					
	9						
21.	6						
	12						
	9						
22.	6						
	12						
	9						
23.	6						
	12						
	9						
24.	6						
	12						
	9						
25.	6	Thund. & Rain, but fair at *Tunbridge Wells*					
	12						
	9						
26.	6						
	12						
	9	Miſling	S. W. 2.	29	50	4	1
27.	6	Fair	w.b.S.1.	29	67		
	12	and	w. 2.	29	78		
	9	Cooler	w. s.w.o.	29	83		
28.	6	Fair	Sw.b s.o.	29	86		
	12	Cool &	S.b.w.3	29	81		
	9	Cloudy	S. 2.	29	80		
29.	6	Rain	S.b.w.3.	29	68	0	0
	12						
	9	Fair	W.S.w.o	29	76		
30.	6	Fair	S. w. o.	29	75		
	12						
	9	Miſling	7	29	41		
31.	6	Fair	w. b. S.5	29	41	0	1
	12	Cooler	VV. 4.	29	52		
	9	Cloudy		29	57		
				Total.		7	03

AUGUST. 1698.

D.	h	Weather.	Winds.	Barom.		Rain.	
1.	6	Fair	S. W. 2	29	51		
	12		W.b.N3	29	49		
	9	ſhowers		29	46	0	13
2.	6		s:w:b:w1	29	43		
	12	ſhowry					
	9		N.b.E1.	29	55	0	39
3.	6		W.b.S.o	29	60		
	12	Fair	N: W: 2	29	62		
	9			29	67		
4.	6	Miſling	s:w:b:w1	29	64		
	12	Fairer	W.n:w2.	29	65		
	9	Rain		29	71		
5.	6	Fair	W.b:n:o	29	75	0	14
	12		w:n.w:2	29	81		
	9	ſhowers		29	87	0	40
6.	6	Cloudy Showers	W:b:S 1	29	88		
	12	Fair	W.b.S.3	29	87		
	9	Cool	N. W. 2	29	87	0	05
7.	6	Fair	N.w.b.w1.	29	84		
	12	Fair.	N.N.w2	29	81		
	9	Fairer	N.N.wo	29	80	0	26
8.	6	Miſty	W.b.S.1	29	72		
	12	Cool	N:N:E1	29	72		
	9	Rain	N:N:Eo	29	72	1	57
9.	6	Cloudy	sw:b:w1	29	63	0	01
	12	Dull	S. W. 2.	29	61		
	9	Day		29	58		
10.	6		n:w:b:n1	29	58		
	12	Rain	N. 1.	29	61		
	9		N. E. o.	29	63	1	40
11.	6	Cloudy	N. 1.	29	63		
	12	Cool	N.b.w.2	29	65		
	9	Day	N. o	29	67		
12.	6		N.b.w.1	29	69		
	12	Miſling	N. 3	29	70		
	9			29	76	0	02
13.	6	Fair &	N.b.w.1	29	79		
	12	Cool	N. 2.	29	84		
	9	Cold	E:b:N.o	29	90		
14.	6		N.b.E.o.	29	98		
	12	Fair	E. 2.	30	01		
	9			30	00		
15.	6	Fair	S.E.b:Eo	29	95		
	12	an	N. E. 2	29	96		
	9	warm		25	98		
16.	6		E. o	30	00		
	12	ſame	E:N:E2	30	04		
	9			30	09		
17.	6	Fair	N. o	30	10		
	12		N.E.1	30	09		
	9	Cloudy		30	05		
18.	6		E. o	29	95		
	12	Cloudy	E. 2.	29	94		
	9		S. 1.	29	85		
19.	6	Fairer	S.S.W.o	29	82		
	12	warm	W.S.w 2	29	81		
	9	Cloudy		29	80		
20.	6	Cloudy	S. W. o.	29	76		
	12		S.W.3.	29	73		
	9	Fair		29	67		
21.	6	Fair	S.wb.s.1	29	59		
	12		S.S:W.2	29	58		
	9	Cloudy		29	55		
22.	6	Cloudy	S.S.E.1.	29	44		
	12		S. 3.				
	9	Rain.		29	37	0	10
23.	6	Rain	S. o	29	48	0	48
	12		SE:b:e:2	29	51		
	9	Thund.		29	47		
				29	41	1	58
24.	6	ſhowers	S:b:E.1	29	42		
	12		S. 3	29	42		
	9	Fair.		29	4	0	01
25.	6	Cloudy	S.W.1.	29	42		
	12		W.b.n.1	29	4		
	9	Fair		29	4		
26.	6		E.S.E. o	29	42		
	12	Fair	N.W.2.	29	41		
	9		N. 1.	29	44		
27.	6	Fair &	S. W. o	29	50		
	12	good h:	N. W. 2	29	58		
	9	weather		29	67		
28.	6		S. W. 1	29	75		
	12	Fair	S. W. 3	29	75		
	9	Rain.		29	76		
29.	6		W. 1.	29	73		
	12	Fair	W.S.w.3	29	76		
	9	Rain		29	73	0	11
30.	6	ſome fair	S. W o	29	7		
	12	& ſome	S.S.w 3	29	7		
	9	Rain		29	8	0	35
31.	6	Cool	N W. o	29	8	0	02
	12	fair with	n w.b.n2	29	8		
	9	Rain		29	84		
				Total		7	02

SEPTEMBER. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.		D.	h.	Weather.	Winds.	Barom.		Rain.	
	6	Cloudy	N.N.W.0	29	80				6	Rain	E.b.N.0	29	39		
1.	12	Cool	W. 1	29	7			17.	12		E.b.S.0	29	36		
	9	Day		29	64				9	Fairer		29	34	1	4
	6		S. W. 1	29	52				6	Rain	E.b.S.0	29	31		
2.	12	Showers	S. w. 3	29	54			18.	12		S. E. 1	29	34		
	9			29	56	0	14		9	Fairer		29	36	1	4
	6		S.S.W.1	29	48				6		E.N.E	29	25		
3.	12	Rain	S. W. 5.	29	45			19.	12	Showers	S. w. 3.	29	25		
	9			29	41	2	55		9			9	31	0	6
	6	Fair	S.W.0.	29	40				6	Rain	S. W 1.			0	1
4.	12		S.b.w.2.	29	37			20.	12	Cloudy.	Sw.b.w2	29	38		
	9	Rain		29	16	0	20		9	Rain		9	42		
	6	Fair	W.s.w.2	29	18	1	1		6	Foggy	S. w. 0.	29	46	0	5
5.	12	Rain						21.	12	Showers	WS.W.1	29	48		
	9	Fair	S. w. 3	29	48	0	05		9	Fair		29	52	0	01
	6	Rain	S.w.b.w2	29	50				6	Hoar Frost	Sw.b.w0	29	47		
6.	12		S. w. 4.	29	46			22.	12	Fair	S. 2.	29	41		
	9	Cloudy		29	47	0	09		9	Rain.		29	37	0	2
	6		S.b.w.4	29	41				6	Fair	S W. 1.	29	42		
7.	12							23.	12	Warm	W.S.w.3	29	4		
	9								9	Cooler		29	44		
	6	Rain							6	Fair	S.S.w 0.	29	44		
8.	12							24.	12	Cooler	S.E.bE1	29	43		
	9	Fair		29	76	0	77		9	Cloudy		29	31		
	6		S. 0.	29	81				6	Rain	S.S.E.2	29	20	0	4
9.	12	Cloudy	S.b.w. 2	29	80			25.	12						
	9		S.b.W.0	29	80				9						
	6	Fog	S. W. 0	29	86				6						
10.	12	Fair	S.b.w.1.	29	89			26.	12	Fair					
	9	Cloudy	W.b.S.0	29	89				9			29	45	0	01
	6		S.b.E.1	29	81				6	Fair and	S.S.E.1	29	42		
11.	12	Rain.	S.b.E.2.	29	70			27.	12	Pleasant	S. 3.	29	42		
				29	61										
	9		E.b.S.0.	29	51	1	34		9	Rain		29	41	0	.1
	6	Fair	N. 1.	29	86	0	01		6	Fair.	S.0	29	40	0	0
12.	12	Warm	E. 2.	29	92			28.	12	Showers	S. 3	29	36		
	9	Day		29	87				9	Fair		29	26	0	.0
	6		E.b.S.0.	29	70				6	Rain	E. b. S.1	29	95	0	0
13.	12	Cloudy	E.b.S.1.	29	61			29.	12	Rain	S.b.E 3	29	06		
	9			29	55				9			29	06	0	.7
	6		E. 0.	29	57				6	Rain	S.b.E.2	29	94		
14.	12	Fairer	N. E. 2	29	62			30.	12	Warm	S.S.W.4	29	07		
	9			29	63				9			29	36	0	.4
	6	and Fair	E.N.E.2	29	60										
15.	12	Warm.1													
	9	Cloudy		29	51										
	6	Rain	N.E.b.E.0.	29	41							Total.		12	0
16.	12	Warm	S.b.E.2.	29	44										
	9	Fair		29	46	0	06								

OCTOBER, 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
1.	7	Miſling	S. 3	29	37		
	12	warm	S:w:bs:4	29	45		
	9	Fair		29	66		
2.	7	Cloudy	S. 2	29	69	0	20
	12	warm &	S. 3	29	71		
	9	Fair		29	77		
3.	7	Rainy	S. 2	29	83		
	12	warm	S.S.E.2	29	83		
	9	Day		29	63	2	87
4.	7	Fair	Sw:b:w1	29	50	1	17
	12	Fair		29	50		
	9	Rain	W.N.w1	29	50	0	36
5.	7	Cloudy	W.N.w2	29	82		
	12	Fair	N.b.w. 3	29	88		
	9	Cooler		29	95		
6.	7		sw:b:w1	30	00		
	12	Cloudy	W.b.n.2	30	03		
	9		W:b:n.0	30	07		
7.	7	Cloudy	W. 1	30	07		
	12	Fair.	W.b.N1	30	07		
	9	Cloudy	W. 0	30	07		
8.	7	Fair &	N.W:0	30	10		
	12	ſomewh	N b.w.1	30	10		
	9	Cooler	N. w. 0.	30	11		
9.	7	Cloudy	N. w. 0	30	07		
	12	and	W.S.w.1	30	03		
	9	Cooler	S: W: 3	29	88		
10.	7	Rain	W:b:N3	29	62	1	55
	12	Fair	w:N:w3	29	76		
	9	Rain	S. w. 3:	29	61		
11.	7	Cloudy	W.b.N3	29	35	0	65
	12	Fair	W:b:N3	29	36		
	9	Cloudy	W:b:N3	26	37		
12.	7	Cloudy	W: 2.	29	30		
	12	& ſome	W. 3	29	30		
	9	Rain		29	27	0	23
13.	7	Fair	W.b.S.0	29	14	0	02
	12	warm	N. 2.	29	09		
	9	Cold		29	08		
14.	7	Fair	W.b.N	29	20		
	12	Rain	N.b.E:2	29	30		
	9	Cloudy		29	42	0	07
15.	7	Hoar-Fr	Nw.bn0	29	47		
	12	Fair &	Nw.bn1	29	47		
	9	Cold		29	47		
16.	7	Icy Fr	N.N:w1	29	50		
	12	Fair &	N:b:w.1	29	58		
	9	Cold		29	61		
17.	7	Ice &	N.Nw1.	29	62		
	12	Fair					
	9	Rain		29	57	0	34
18.	7	Ice	S. 1	29	44		
	12	Cloudy	S: W. 2	29	33		
	9	Fair		29	15		
19.	7	Cold	E.S E.2	28	98		
	12		S:b:E:2	28	84		
	9	Rain.		28	83	1	20
20.	7	Cold	S. W. 2	29	01	0	41
	12	and	W.b.S.2	29	12		
	9	Cloudy		29	24		
21.	7	Froſt &	N. 0.	29	23		
	12	Fair.	N.W.2.	29	24		
	9	Cloudy		29	46		
22.	7	ſhowers	N.N.E0	29	50		
	12	Hail	S. 2.	29	51		
	9	ſhowers		29	57	1	41
23.	7	Hard-Fr	SEb E.0	29	65		
	12	& Fair	E.S.E.1	29	68		
	9	ſhowers		29	70		
24.	7	Fair	E: 0:	29	62	0	04
	12	warm					
	9	Rain.		29	58	0	10
25.	7	Rain	S. 3	29	40	0	11
	12	Mild	S. b. E.3	29	24		
	9	weather		29	4[illegible]		
26.	7	Cloudy	S.S:E.2	29	48		
	12	Fair and warm	S.E.b.S3	29	47		
	9	Rain		29	43		
27.	7	Fair	S.b.w.0.	29	52		
	12	Cloudy		29	5[illegible]		
	9	Rain		29	42	0	8
28.	7	Miſt	V. 0	29	41		
	12	Fairer	N.N.E2	29	24		
	9	Rain		29	46	0	05
29.	7	Cloudy	Nb:E 2.	29	41		
	12	Colder	N.b.E.1	29	41		
	9	Rain		29	41		
30.	7	Snow	N.b.E.4	29	22	1	23
	12	Sleet	N. 3	29	23		
	9	Fairer		29	42	0	29
31.	7	Hard Fr		29	62		
	12	Cloudy					
	9			29	76		
				Total		13	08

NOVEMBER. 1698.

D.	h.	Weather	Winds.	Barom.		Rain.	
	8	Froſt	S.W.b.S.2	29	63		
1.	12	Sleet	S. W. 2	29	62		
	9	Cloudy		29	65	0	12
	8	Fair	S.S.W.0.	29	67	0	06
2.	12	Warmer	S.S.W.1.	29	68		
	9	Showers		29	64	0	02
	8	Fair	S. 1.	29	55		
3.	12						
	9	Cloudy	S.b.W.3.	29	49		
	8	Showers	S. 3	29	40		
4.	12	Warm &	S. 3	29	30		
	9	Cloudy	S. 4	29	15	0	11
	8	Rain	W.S W5	29	98	0	19
5.	12	Fair and	SWbW6.	29	14		
	9	Pleaſant	SWbW0.	29	37		
	8	Froſt	SWbW0.	29	45		
6.	12	Fair and	S.b.W.0	29	45		
	9	Cold	S.b.W.0	29	43		
	8	Rain	SWbW3.	29	22	0	26
7.	12	Fair and	W.b.S.4	29	28		
	9	Warmer	S.W.b.S 1	29	42		
	8	Rain	S. 1.	29	24		
8.	12		W.b.S.2	29	12		
	9	Fairer	W.S.W 2.	29	27	2	30
	8	Fair	S. W. 3.	29	33	0	23
9.	12	Cloudy	W.S.W.2.	29	22		
	9	Snow	S.S.E.1	29	27		
	8	Cloudy	WSW0.	29	42	0	36
10.	12	Miſty	S.W.b.S.1	29	48		
	9	Day		29	47		
	8	Snow and	N.b.E.1	29	48		
11.	12	Sleet all Day	N.b.E.1	29	47		
	9	Snow		29	43	2	66
	8	Snow 3	N.b.W2	29	46	2	56
12.	12	Inches,	N.b.W1	29	54		
	9	Cloudy		29	65	0	65
	8	Hard Fr.	W.b.S.0	29	60		
13.	12	and	W.S.W.1	29	58		
	9	Fair		29	62		
	8	Fair, Snow	W.S.W.1	29	63		
14.	12	and Hard	W.b.S.2	29	61		
	9			29	70		
	8	Froſt	NNW1.	29	90		
15.	12	Miſty &	W.b.N0	29	98		
	9	leſs Cold		30	01		
	8	Cloudy	S. 1.	29	9		
16.	12	Fair	S.S.E.2	29	92		
	9	Thaw		29	81		
	8	Froſt	S. 0	29	67	0	18
17.	12	and					
	9	Fair		29	37		
	8	Rain	S.E.b.S.2.	29	07		
18.	12	Fair and	SWbW2.	29	16		
	9	Cold		29	31	0	04
	8	Rain &	S b. E 2	29	28		
19.	12	Cold thaw	S.W b.S.3	29	14		
	9	Fair		29	20	0	10
	8	Rain	S. W. 2	29	20	0	44
20.	12	Fair and	S. W. 4.	29	27		
	9	Warm		29	31		
	8	Rain	S. W. 4	29	14	2	81
21.	12	Fair and	S. W. 3	29	20		
	9	Warm		29	48		
	8	Froſt &	W.b.S.1	29	77		
22.	12	Fair		29	83		
	9	Cloudy		29	75		
	8	Rain &					
23.	12	warm					
	9						
	8						
24.	12	Rain					
	9	Stormy		29	75	1	15
	8	Some	S.W.b.S.8	29	15	0	61
25.	12	Fair	S.W.b.W8	29	30		
	9	Some Rain	3	29	52	0	25
	8		S. W. 4	29	41		
26.	12	Rain	SWbW5.	29	33		
	9			29	30	0	05
	8	Small Fr	W.S.W.3	29	25		
27.	12	and	W.S.W.3	29	27		
	9	Fair		29	53		
	8		W b.S.1	29	41		
28.	12	Same	W.b.N.1	29	44		
	9			29	37		
	8	Snow	E.b.N.1	29	13		
29.	12		E.b.N.2	29	09		
	9	Sleet		29	17	0	74
	8	Froſt &	N.b.W4	29	56		
30.	12	Fair	NNW2.	29	66		
	9	Rain		29	86	0	01
				Total		16	83

DECEMBER. 1698.

D.	h.	Weather.	Winds.	Barom.		Rain.	
	8	Hard Fr.	N:b:Wo	29	85		
1.	12	Fair	E:b:S:o.	29	80		
	9	Snow 3.		29	78		
	8		W.N.wo	29	93		
2.	12	Foggy	W:b.N	30	01		
	9			30	11		
	8	Cloudy	W.b S.o				
3.	12	with gen	W.b.S:o.	30	15		
	9	tle thaw	W:b.S.o	30	16	1	32
	8		W.b.S.o	30	09		
4.	12	Foggy	S. w. o	30	08		
	9		s.w.b.s.o	30	06		
	8	Fog &	s.w.b.s.o	30	02		
5.	12	Miſling	S:b.w o	30	03		
	9		S:b:E:o:	30	00	0	41
	8	Fog	E.S.E.1.	29	97		
6.	12	warm	E: 2:	29	94		
	9	Clearer	S.e.b.e.1	29	92		
	8	Miſty	S: E: o:	29	92		
7.	12	Clearer	S.E:o:	29	91		
	9	Miſty	E.b.S.o.	29	88		
	8	Miſt	E.b S.o	29	83	0	04
8.	12	Fair	E.b.S.1	29	86		
	9	Fog	Sw.b.s.o	29	94	0	12
	8	Rain	S:b:w:2.	29	99	0	03
9.	12	Cloudy	S.b.w.3	29	98		
	9	and warm	S.S.w.4.	29	91		
	8	Cloudy	S. 6.	29	66		
10.	12	Rain	W.b.S.6.	29	64		
	9	Fair	W.b.S.2	29	96	0	49
	8	Fair &	W.S w.4	30	10		
11.	12	Cooler	S. W: 3.	30	14		
	9	Cloudy		30	00		
	8	Rain	w.N.w.3	29	79	0	72
12.	12	Fair					
	9			30	11		
	8	Froſt	s.e.b.s.o	30	10		
13.	12	Fair	S.S:E.1.	30	06	0	
	9	Cloudy		29	96		
	8						
14.	12						
	9	Rain					
	8						
15.	12						
	9						
	8	Cloudy	S.b.W.2.	29	60	0	01
16.	12	Rain	S. 3.	29	50		
	9	warm	7	29	44		
	8	Rain	S.b.W.6	29	09		
17.	12	Warm Cloudy	S.b.w.6.	29	10		
	9	Rain		29	22	0	42
	8	Cloudy	S.w.b.s3	29	32	0	4
18.	12	and	S.w:b.s2	29	30		
	9	warm		29	34		
	8	Fair	S.b.W.o	29	72		
19.	12	Cooler	S:b:E:1	29	67		
	9	Rain		29	35		
	8		S. 3	29	23	0	56
20.	12	Rain	S. b. E. 5	28	98		
	9			28	68	0	24
	8	Fair &	W. 4.	29	36		
21.	12	Colder	W. 3.	29	52		
	9	Rain		29	52		
	8		W:b:S:4	29	49	0	17
22.	12	Fair	W.S.w.3	29	55		
	9			29	66		
	8			29	81		
23.	12	Cloudy					
	9		6	29	65		
	8	Cloudy	S. W. 7	29	34		
24.	12	warm	W.b.N8	29	56		
	9	Fair	2	29	82		
	8		W.b.S. 2	29	94		
25.	12	Fair	W.S.w.2	29	95		
	9			30	00		
	8	Cloudy	W.b.S.3	29	93		
26.	12	and	W.b.S.4	29	90		
	9	warm		29	77		
	8	Rain	W.b.S.4	29	50		
27.	12	Colder	Sw.b.w.4	29	43		
	9	Fairer				0	21
	8	Froſt &	S. W. 3	29	49		
28.	12	Fair					
	9	Froſt		29	40		
	8	warmer	S. W. 17	28	88		
29.	12	Rain	S. W. 8	28	79		
	9	Colder		28	69		
	8	Snow	W.b. S.3	28	79	0	69
30.	12	Froſt &	W.b.S.3	28	89		
	9	Fair.					
	8	Froſt	W. o	29	23		
31.	12	and	W.N.W2	29	36		
	9	Fair		29	67		
				Total		5	85

XXV.

The Rain 1697. and 1698. at Townley; By Mr Townley n. 249. p. 47.

	1697	1698		1697	1658
Jan.	10 26	12 94	*Jul.*	27 00	20 74
Feb.	14 34	11 76	*Aug.*	80 50	43 00
Mar.	9 86	40 32	*Sept.*	93 80	43 58
Apr.	8 24	41 90	*Oct.*	55 20	44 52
May	23 76	17 90	*Nov.*	21 44	49 44
Jun.	17 84	12 90	*Dec.*	49 00	40 84
			Sum.	411 24	379 84

As for as I have learned, the Mercury riſes and falls much after the ſame Meaſure in moſt parts of our Iſland, and of this you may better Judge by ſome Obſervations I have here tranſcribed and ſent you, of the very low Stations, *Decemb.* 28. about 3 of the Clock Mercury 28, 17; on the 29. about 2 *h* ½ 28, 18; and *Jan.* 2. about the ſame Hour 28, 05. and this time it hardly riſe before I went to Bed; and on the *6th* ſtill about 3. *h.* 28, 19; but this time before 9 at Night it was got to 29. 28. What I note, is that though once I ſaw it lower many Years ago, yet never ſince I kept my Obſervations, did the Quickſilver Deſcend ſo often to thoſe Pitches; or when it was found very low, did it ever continue ſo for any conſiderable time, as it hath done this Year, during which it hath never been very high, and as I remember, generally much lower than other Years. This hath proved very unſeaſonable here, and ſo backward, that I thought I had never known the like, but examining my Obſervations, I find that of 1673 much what as late, though the Conſequence proved not ſo fatal to theſe parts of all *Europe*, as this.

The Weather 1698. and 1699. at Emuy in China; By Mr. Ja. Cuningham. n. 256. p. 123

XXVI. At *Emuy* in *China* in the Latitude of 24°. 20′. N. *An.* 1698. *Octob.* From 1. to 8. the Weather was Fair and Clear, the Mercury's Alt. $29\frac{14}{20}$. Digit. From the 8*th* to the 11*th*. Cloſe and Cloudy Weather, the Mercury falling to $29\frac{11}{10}$ Dig.

11. Cloſe Weather, ſomewhat Cloudy. 12. Cloſe Weather blowing freſh at *N. E.* 13. and 14. Cloſe and Cloudy Weather with much Rain, and freſh Winds from *N. E.* to *N. W.*

The *Tide*, (which commonly flow 3 Fathoms) did flow above half a Foot higher 3 Days after the Full Moon, than it did on the Full Moon at the Æquinox

15. Fair and Clear Weather, with ſmall Gales at *N. E.* From the 15 to the 24 fine moderate fair Weather, with ſmall Gales at *N. E.* to and the 31*ſt* Winds and Weather variable.

Nov. 1. to the 14. variable, Cloſe and Cloudy Weather, with ſome Rain, and variable Gales round the Compaſs.

15. Fair and Clear Weather, with ſmall Gales at *N. E.* in the Morning the Mercury's Alt. $29\frac{11}{10}$, at Noon $29\frac{11}{10}$, and at 10 of the Night being Cold, riſing

ſing to $29\frac{16}{20}$. 16. At Sun riſing very cold, the *Mercury*'s Alt. $29\frac{18}{20}$. At Noon fair and pleaſant Weather, the *Mercury* falling to $29\frac{17}{20}$. At Night Cold, riſing to $29\frac{18}{20}$. The Wind at *N. E.* 17. This Morning cold, the *Mercury* at $29\frac{18}{20}$, fair and clear Weather all Day, and at Night blowing ſomewhat freſh at *N. E.* the *Mercury* at $29\frac{17}{20}$. 18. This Morning cold, the *Mercury* at $29\frac{17}{20}$. All Day fair and pleaſant Weather, the Mercury falling to $29\frac{14}{20}$, and by Noon to $29\frac{12}{20}$. The Weather fair, ſomewhat cloſe and cloudy, the Afternoon Sun ſhining and warm, and at Night temperate, the Mercury continuing at $29\frac{13}{20}$. Small Winds at *N. E.* and almoſt calm.

20. A pleaſant Sun-ſhining Morning, the Mercury at $29\frac{12}{20}$. At Noon overcaſt and cloudy, with little wind at *N. E* the Mercury falling to $29\frac{10}{20}$. In the Afternoon ſome drops of Rain, with cloſe Weather, and at Night the Mercury continuing at $29\frac{10}{20}$, with ſmall weſterly Winds. Some Rain in the Night. 21. Cloſe and cloudy Weather with ſmall Gales, at *N. E.* the Mercury at $29\frac{11}{20}$ in the Morning, and continued ſo all Day, with ſome Drops of Rain in the Afternoon, the Gale freſhning, and a Shower of Rain at 8 of the Night, the Mercury riſing to $29\frac{12}{20}$. 22. Gray and cloudy Weather all day, with freſh Gales between *E.* and *N. E.* The Mercury at 29[illegible], and at Night riſing to $29\frac{13}{20}$. Fair Weather ſomewhat cloudy. 23. A very cold Morning, fair and clear, with freſh Gales from *N. E.* to *N.* the Mercury at 30 Dig. fair and clear all day, with a moderate Gale about *N E.* Clear and very cold all Night, the Mercury continuing at 30 Dig. 24. A fair, clear and cold Morning, the Wind at *N. E.* a moderate Gale, the Mercury continuing at 30 Dig. A clear Sun-ſhining Day, cold and clear all Night, the Mercury as before. 25. A ſharp cold Morning, fair and clear, with a moderate Gale at *N.W.* the Mercury fallen to 29. All day fair and pleaſant, very warm and no Wind, the Mercury falling at Noon to $29\frac{18}{20}$, and at Night being ſomewhat hazy and calm withal, to $29\frac{11}{20}$. 26. Temperate Weather all Night, and this Morning ſomewhat cloſe and hazy, and no Wind, the Mercury at $29\frac{14}{20}$, and towards Noon growing clearer and warmer, riſing to $29\frac{16}{20}$. Small Breezes at *N.E.* at Night falling to $29\frac{14}{20}$. Temperate Weather. 27. Fine pleaſant weather all Day with ſmall variable Breezes from the *N.* to *W.* and about to *S.* the Mercury in the Morning at $29\frac{13}{20}$, and at Noon falling to $29\frac{12}{20}$, and at Night riſing to $29\frac{14}{20}$. Fair Weather and calm. 28 Fine moderate Weather, with a Gale at *N. E.* the Mercury at $29\frac{14}{20}$. In the Afternoon the Gale freſhned, the Weather ſomewhat cloudy, and at Night the Mercury was at $29\frac{15}{20}$. Blowing freſh. 29. Fair and clear Weather, ſomewhat cold this Morning, with a freſh Gale at *N E.* the Mercury at $29\frac{16}{20}$ fine pleaſant Weather all day, with ſmall Gales at *N. E.* at Noon the Mercury falling to $29\frac{15}{20}$; and at Night being clear and ſomewhat cold, riſing to $29\frac{17}{20}$. 30. Fair and pleaſant Weather, with ſmall Gales at *N. E.* The Mercury at $29\frac{17}{20}$. At Noon a freſh Gale, the Mercury falling to $29\frac{14}{20}$. At Night temperate Weather, and little Wind, the Mercury riſing to $29\frac{16}{20}$.

Dec. 1. Fine temperate Weather, with ſmall Gales at *N. E.* the Mercury at $29\frac{16}{20}$ in the Morning. Fair Weather all Day, and ſmall Breezes at *N. E.* The Mercury at Noon falling to $29\frac{14}{20}$, and in the Evening to $29\frac{13}{20}$, and at Night riſing to $29\frac{13}{20}$, being fine clear Weather. 2. Fair and temperate

Weather, ſomewhat Cloudy, and overcaſt with ſmall Gales at *N. E.* The *Mercury* at $29\frac{14}{20}$ and at Night riſing to $29\frac{14}{20}$. 3. A Clear and Cold Morning, with a fine Sharp Gale at *N. b. E.* The *Mercury* at $29\frac{11}{20}$. A Cold Air all Day, the *Mercury* at Noon falling to $29\frac{15}{20}$, and at Night, the Gale freſhning made it Colder, the Mercury riſing to $29\frac{13}{20}$. 4. A Sharp Morning with a Freſh Gale at *N. b. E.* The Mercury at $29\frac{10}{20}$. Fair and Clear all Day, with a ſmall Northerly Gale, the Mercury by Noon falling to $29\frac{12}{20}$. A Serene Temperate Night, and almoſt Calm, the Mercury as before. 5. A Fine Clear Morning with a moderate Gale at *S. W.* ſomewhat Cold, the Mercury at $29\frac{11}{20}$. At Noon a ſmall Breeze, at *E. b. S.* Pleaſant Weather, the Mercury at $29\frac{12}{20}$. At Night a ſmall Gale at *S. b. E.* Fair and Temperate Weather, ſomewhat Hazy, the Mercury at $29\frac{13}{20}$.

6. This Morning ſomewhat Cloſe and Cloudy, with a few Drops of Rain, the Weather Temperate, with ſmall Southerly Breezes, the Mercury at $29\frac{11}{20}$. The Afternoon Calm, and ſomewhat Hazy, the Mercury falling to $29\frac{10}{20}$. At Night overcaſt and Cloudy, with ſome Rain, blowing freſh at *N.* the Mercury riſing to $29\frac{14}{20}$. 7. A Gray Morning, Clearing up with a freſh Gale at *N. E.* the Mercury at $29\frac{17}{20}$. In the Afternoon the Horizon a little Hazy, the Mercury falling to $29\frac{15}{20}$. At Night Clearer, with a Freſher Gale, the Mercury riſing to $29\frac{18}{20}$. A very Cold Night. 8. A Sharp Clear Morning, with a fine Gale at *N. E* the Mercury at 30. At Noon falling to $29\frac{18}{20}$, a fine Sun-ſhining Day. At Night Cold and Clear, a ſmall Gale at *N. E.* the Mercury riſing to 30. 9. This Morning as the laſt, all Day and Night the ſame, and the Mercury alſo.

10. A Cold Morning, ſomewhat Foggy, with a fine Gale at *N. E.* the Mercury at 30. All Day fair, Clear and Sun-ſhining. At Night Cold, the Mercury at $29\frac{19}{20}$. 11. A Cold Morning with a Moderate Gale at *N.W.* the Mercury at $29\frac{17}{20}$. All Day Fair and Clear; the Mercury falling to $29\frac{16}{20}$. At Night a freſh Gale at *N.E.* the Mercury at $29\frac{15}{20}$. 12. A Gray Cold Morning, ſomewhat Cloudy, with a Hazy Horizon, a freſh Gale at *N.E.* the Mercury at $29\frac{19}{20}$; towards Noon falling to $29\frac{17}{20}$ with little Wind, and fair Weather; at Night Calm and ſomewhat Cold, the Mercury riſing to $29\frac{18}{20}$. 13. A Fine Pleaſant Morning, with a ſmall Breeze at *N. W.* the Mercury at $29\frac{18}{20}$. At Noon a ſmall Gale at *N.E.* and in the Afternoon Calm the Mercury falling to $29\frac{14}{20}$. All Day ſerene; at Night Calm; with a Clear Sky, ſomewhat Cold, the Mercury riſing to $29\frac{15}{20}$. 14. A fine Temperate Morning, with ſome ſmall Rain like Dew, and a moderate Gale at *S. W.* the Mercury at $29\frac{15}{20}$. The afternoon a little overcaſt and the Horizon ſomewhat Hazy, a ſmall Gale at *S. E.* the Mercury falling to $29\frac{13}{20}$. At Night Temperate and Calm, the Mercury riſing to $29\frac{14}{20}$. 15. A fine Temperate Calm Morning, the Mercury at $29\frac{15}{20}$. At Noon Fair, Pleaſant Calm Weather, the Mercury fallen to $29\frac{12}{20}$. All the Afternoon, and at Night a freſh Gale at *N.E.* Fair Weather, the Mercury riſing to $29\frac{14}{20}$. 16. A Gray Cloudy Morning ſomewhat Hazy, with a freſh gale at *N. E.* the Mercury at $29\frac{17}{20}$. At Noon Fair and Clear, and gale moderate, and the Mercury falling almoſt to $29\frac{14}{20}$. The Afternoon ſomewhat Cloudy with a fine gale at *N. E.* At Night a little Wind, Serene and Sharp, the Mercury riſing to $29\frac{15}{20}$. 17. A gray

Morning ſomewhat Cold, with a fine Gale at *N. E.* the Mercury at $29\frac{17}{20}$ and at Noon falling to $29\frac{15}{20}$. At Night little Wind, the Mercury riſing to $29\frac{16}{20}$. 18. A fair temperate calm Morning, ſomewhat Foggy, the Mercury at $29\frac{17}{20}$. All Day fair weather, ſomewhat Cloudy with ſmall winds at *N. E.* the Mercury falling to $29\frac{15}{20}$. At Night blowing freſh, the Mercury riſing to $29\frac{18}{20}$. 19. A gray cloudy Morning with a freſh Gale at *N. E.* the Mercury at $29\frac{18}{20}$. Cloſe thick weather, with continual Rain all Day and Night, and a moderate Gale at *N. E.* at Night the Mercury riſing to $29\frac{19}{20}$. 20. Cloſe thick rainy weather, in the Morning, with a moderate Gale at *N.E.* the Mercury falling below $29\frac{18}{20}$. And by Noon to $29\frac{16}{20}$. continual thick rainy weather all Day and Night, the Mercury at $29\frac{16}{20}$. and the Gale as before.

21. A gray cloudy Morning, but fair and beginning to clear up and calm withal, the Mercury at $29\frac{14}{20}$. at Noon fair weather, and ſomewhat clear, with a ſmall Gale at *S. W.* the Mercury falling to $29\frac{13}{20}$. At Night calm and ſomewhat cloudy, the Mercury at $29\frac{14}{20}$. 22. A gray cloudy Morning continuing ſo all Day, with a ſmall Gale at *N E.* the Mercury at $29\frac{14}{20}$. at Night riſing to $29\frac{15}{20}$. 23. A gray cloudy Morning continuing ſo all Day, with ſmall Gales at *N. E.* the Mercury at $29\frac{14}{20}$, at Night more Serene the Mercury riſing to $29\frac{15}{20}$. 24. A gray Morning and calm weather, the Mercury at $29\frac{15}{20}$. Cloſe and cloudy weather all Day and no wind, the Mercury falling to $29\frac{14}{20}$. At Night riſing almoſt to $29\frac{15}{20}$. 25. A gray cloudy Morning (ſome Rain before Day-light) with ſmall *Southerly* Breezes, the Mercury at $29\frac{14}{20}$. Towards Noon Sun-ſhining and pleaſant, little wind variable, the Mercury falling to $29\frac{12}{20}$. The Afternoon and at Night overcaſt and cloudy, the wind at *S. b. E.* and the Mercury riſing to $29\frac{15}{20}$. 27. A fine pleaſant Morning, with a Hazy Horizon, and altogether calm, the Mercury at $29\frac{13}{20}$, and by Noon at $29\frac{11}{20}$ All Day pleaſant weather, and at Night ſmall Gales at *North Eaſt*, the Mercury riſing to $29\frac{12}{20}$. 28. A fine pleaſant Morning with a ſmall Breeze at *E. N. E* the Horizon ſomewhat Hazy, and the Mercury at $29\frac{11}{20}$. at Noon falling to $29\frac{10}{20}$. All Day fair and pleaſant weather with the aforeſaid Breeze. At Night calm, the Mercury falling almoſt to $29\frac{9}{20}$ 29. A gray Morning, with a cloſe Horizon and a ſmall Breeze about *E. N. E.* the Mercury at $29\frac{9}{20}$. Calm all the Forenoon, in the Afternoon pleaſant weather, with a ſmall Gale at *S. E.* the Mercury at $29\frac{6}{20}$. At Night Calm, the Mercury at $29\frac{7}{20}$. 30. A gray cloudy Morning, and cloſe weather, with a freſh Gale at *S. E.* the Mercury at $29\frac{10}{20}$. All Day cloudy and dark, the Gale freſhning and veering to *E. N. E.* the Mercury riſing to $29\frac{11}{20}$. 31. Gray cloudy weather all Day, with a freſh Gale at *N. E.* in the Evening ſome Rain, blowing freſh all Night.

Jan. 1. 1699. Variable Weather with ſmall Gales at *N. E.* 2. Rainy thick weather all Day and Night with little Wind at *N. E.* 3. Continual thick rainy weather all day and night, the Wind at *N. E.* 4. Fair weather ſomewhat cloſe, and calm all day and night. 5. Cloſe weather with ſome Rain and calm this Forenoon; and in the Afternoon a ſmall Breeze at *W. N. W.*

XXVII.
The Weather 1699 *at* Upminſter; *By* Mr. Wil. Derham, n. 262. p 527.

JANUARY 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom	Ther.	Rain
	8	Froſt	S.E.b.S.o		29 77		
1.	12	Fair	S.S.E. 1		29 73		
	9	Snow			29 43		
	8	Rain	S. 3		29 21		0 63
2.	12	Warmer					
	9	& Rain	S.b.E 3.		28 76		0 29
	8		S. 3	S.b.W.	28 57		0 37
3.	12	Same					
	9		S.b w. 3		28 47		
	8	Cloudy	S S.W. 3	Swbw.	28 44	110	
4.	12	Fairer	S.W.4		28 56	09	
	9		S. w. 4		28 72	105	
	8	Froſt	S. W. 3.		29 22	85	
5.	12	and Fair	S. 1.		29 29	94	
	9	Rain					
	8	Rain.	S. 0.		28 67	104	0 75
6.	12	Warm			28 61	105	
	9	Snow	S 5				0 48
	8	ſmall Fr.	S. w. 2		29 00	85	
7.	12	Fair	Swb. w. 3	S.b.W	29 08	86	
	9	Rain	S.b.w.0	S. W	29 19	85	0 03
	8	Froſt	S. W 0	WSW.	29 34	85	
8.	12	and	W.b.S.1	S. W.	29 44	88	
	9	Fair			29 70	88	
	8	Hard F.			29 72		
9.	12	and					
	9	Fair			29 73		
	8		E.b.S.1.	E.S.E	29 82	85	
10.	12	Same	S.E.bE2		29 82	89	
	9				29 60		
	8	Rain	S. w. 2	w.S.w	29 59	101	0 40
11.	12	Cloudy	S. w.bw2	w.	29 59	99	
	9				29 71	102	
	8	Cloudy	S.w.b.S.0		29 69	103	
12.	12	Miſling	S. w. 2		29 66	109	
	9	Rain		W.b.S.	29 59	101	
	8	Fair	S.w:bw3	W.	29 48	93	0 16
13.	12	Cloudy	w:b:S:3	W.b.N	29 42	107	
	9	Rain			29 48	93	
	8	Fairer	Nwbw4	N. W.	29 53	94	0 14
14.	12		N:b:w:4	N. bW	29 69		
	9	Cloudy			29 97	96	
	8	Rain	N. 1		30 12	93	0 16
15	12	Cloudy	N.b.w.1.		30 14	94	
	9	Day			30 17	82	
	8	Froſt	w.b:S 0	Nb. W	30 10	8	
16.	12						
	9	Cloudy			30 15	9	

D.	h.	Weather.	Winds.	Clouds.	Barom	Ther.	ai
	8		Nwbw0		30 21	94	
17.	12	Foggy.	N. w. 0		30 24	100	
	9				30 27	94	
	8	Fog	W. 0		30 26		
18.	12						
	9						
	8	Fog					
19.	12						
	9				30 34	77	
	8	Hard F.	S. 0		30 27	70	
20.	12	Fair	S.b.E.1		30 24		
	9	Foggy			30 21	76	
	8	Hard F.	S. b. E 0		30 18	62	
21.	12	Fog	E. b.N.1	E.N.E	30 18	82	
	9	Fair			30 18	81	
	8	Froſt	E. b.N.1		30 16	77	
22.	12	and	E.b.N.2	E.b.N	30 18	86	
	9	Fair			30 19	84	
	8	Cloudy	N.E.2		30 15	87	
23.	12	Fair					
	9	Small F			30 13	81	
	8	Froſt	E.b.N.0		30 13	73	
24.	12	and	E. 2		30 14	88	
	9	Fair			30 12	78	
	8	Froſt	E. 0		30 11	73	
25.	12	Fair and pleaſant,	E. 1		30 12	86	
	9	Day.			30 09	79	
	8		E. 0		30 05	70	
26.	12	Same	E. 1			88	
	9				29 96		
	8	Froſt &	E.N.E.0	E.	29 76	76	
27.	12	Cloudy	E.b.N.1		29 72	85	
	9	Fair			29 59	76	
	8	Rain	S. E. 2	S.E.bS	29 48	89	
28.	12	and	E.b.E.2	S.	29 47	92	
	9	Thaw			29 66	93	1 51
	8	Froſt	S.w.b.S0	w.b. N	29 86	85	
29.	12	Fair	S. 1		29 87	92	
	9	Rain			29 7	98	
	8	Cloudy	S. 2	S	29 56	107	0 8
30.	12	Warm	S. 3	S.b.w	29 49	115	
	9	Day	S.S.w.3	S.w.bS	29 4	109	
	8	Cloudy	S. b. w 2	w.S.w	29 4	108	0 1
31.	12		S. 3		29 37	113	
	9	Rain	S.S.E.2	S.S.E	29 47	109	
					Total.		8 9

FEBRUARY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
1.	7	Fair	S. W. 1		29 43	98	
	12	Pleaſant	W.b.S.2.	S. W	29 53	108	
	9	Day	W.b.S.0		29 77	83	
2.	7	Small Fr.	W.S W0	W.N.W	29 88	79	
	12	Hazy	S.b.W.0.		29 91	95	
	9	Rain	S. 1.		29 85	100	0 05
3.	7	Rain	S S.E. 3	S. b. E	29 59	100	
	12		S.b.W.3	S. W.	29 51	105	
	9	Fair	WbW.1		29 64	92	1 05
4.	7	Small Fr. Fair	w.S.w.1	W.N. W	29 74	82	
	12	Cloudy	W. 2.	N.b.W.	29 80	101	
	9	Rain	S. 1.	S. W	29 7	89	
5.	7	Cloudy	sWbW3.	w. S. w.	29 48	104	0 37
	12	Fair	w.S.w.3.	W.	29 51	113	
	9	Rain	W.b.S.3.	W.	29 48	91	
6.	7	Small Fr	W. b.N1		29 76	85	
	12	Fair					
	9	Rain			29 52	93	
7.	7	Violent	W. 8.	W.b.N	28 99	103	1 52
	12	Storms	wNw.10	N. W	29 22	101	
	9				29 78	92	
8.	7	Cloudy	N.W.0.	Nw.b.N	29 98	88	
	12	Fair	S.b.W.1	N. w.	30 00	101	
	9	Cloudy			29 88	99	
9.	7	Miſling	WSW3.	N.b.N.	29 79	106	
	12						
	9	Fair			30 07	87	0 20
10.	7	Hoar Fr.	S. W. 2.	N.N.w.	30 0.	88	
	12	Somewhat	W. 3	N.	30 03	109	
	9	Fair			30 01	95	
11.	7	Cloudy	W.b.S.1	N. w.	29 98	87	
	12		S. W. 2	W.b.N.	29 99	107	
	9	Fairer			29 98	96	
12.	7	Fair	S. W. 2	N.b.W.	29 94	84	
	12	Hazy	S. W. 3	N. w.	29 84	102	
	9	Cloudy Ra.	5		29 46	101	
13.	7		W: 4	W.	29 34	107	0 02
	12						
	9						
14.	7						
	12						
	9						
15.	7						
	12						
	9						
16.	7	Rain					1 50
	12	loudy	E.b.N.2	N. E.	29 37	102	
	9				29 52	97	

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain
17.	7		E.b.N.0		29 76	93	
	12	Cloudy	E.b.N.1	w. b. S.	29 82	109	
	9	Rain			29 83	94	
18.	7	Fair and	w. Nw.1		29 84	91	0 05
	12	Pleaſant	N. W. 1		29 93	110	
	9	Rain			29 80	99	
19.	7		W b.S.		29 7	87	0 13
	12	Fair	w.b. N.4		29 77	104	
	9				29 94	90	
20.	7	Froſt	w.S.w.1		30 00	82	
	12	and					
	9	Fair			29 98	97	
21.	7	Cloudy	w.S.w.1	w.N.w.	29 9	92	
	12		W.b.N2		29 92	110	
	9	Fairer			29 91	90	
22.	7	Cloudy	W.b.S. 2	w. N. w	29 81	84	
	12	Sleet	N. w. 3		29 72	100	
	9	Cold			29 75	79	0 09
23.	7	H. Froſt	N. w. 2		29 83	75	
	12	Fair					
	9	Sleet			29 59	86	
24.	7	Cloudy	NN.w.0		29 60	92	0 40
	12	Bluſter					
	9	Fairer			29 9	85	
25.	7	Fair	Nwbw1.		29 90	83	
	12	Cloudy	S.wbw. 1	N. w.	29 82	102	
	9	Rain			29 75	96	
26.	7	Fair	w. 1	w. N. w.	29 77	86	0 08
	12	and	W.b.N1		29 83	105	
	9	Pleaſant			29 77	95	
27.	7	Rain	WbS.2.	w. b. N.	29 64	99	
	12		Nwbw3		29 67	103	
	9	Fair			29 71	92	0 45
28.	7	Cloudy	S. W. 3	w.	29 58	93	
	12						
	9						0 10
					Total		5 05

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D.	h.	Weather.	Winds.	Clouds.	Barom.		Ther.	Rain.
	6	Fair						
1.	12							
	9	Sleet	N.b.E.2		29	26	80	0 12
	6	Snow	N:b:w:3		29	40	82	
2.	12	Fair						
	9				29	64	8	0 04
	6	Hard F.	NwbNO.		29	72	68	
3.	12	Fair	W. 1		29	77	96	
	9	Cloudy	W.b:S 1	N. W.	29	78	90	
	6	Cloudy	N.b.w.2	N.NE	29	82	9	
4.	12	Rain	N. 2		29	9	98	
	9	Cloudy	N. 2		30	02	90	0 02
	6	Froſt	N. w. o	N.	30	11	79	
5.	12	Cloudy	N:b:E:1	Nb. W	30	15	94	
	9	Fairer	N.b.w.o		30	19	77	
	6	Hard F.	N.N.wo		30	11	65	
6.	12	Fair	E. 1	N.b.E	30	07	96	
	9	Cloudy	S.b.E.o		29	95	87	
	6		S. E. 1	S.b.E.	29	82	8.	
7.	12	Fair	S.E.b.S	S. E.	29	83	107	
	9	Cloudy			29	88	80	
	6		E.S.E.o	N.E.b.E	29	97	82	
8.	12	Fair	E b N.2		30	05		
	9				30	11	85	
	6	Froſt	N.E.o		30	12	80	
9.	12	and	E.N.E.2		30	13	98	
	9	Coudy			30	14	87	
	6		N.b.E.o	E.	30	10	85	
10.	12	Cloudy	N.b.E.1.		30	11	103	
	9				30	08	91	
	6	Small	E.b.N o		30	00	86	
11.	12	Rain	S.b.w.2	S.	29	97	102	
	9				29	93	92	0 41
	6		S. 1		29	84	93	0 18
12.	12	Cloudy	S.b.w. 1		29	84	106	
	9				29	78	97	
	6	Rain	S.b.w.1		29	63	93	0 01
13.	12		S.b.E.1.		29	58	102	
	9	Fairer			29	69	88	1 68
	6	Froſt	W. o		29	80	81	
14.	12	Fair						
	9	Cloudy			29	84	108	
	6		S:w:bS.2	W.b.S.	29	87	107	
15.	12	Cloudy						
	9				30	02	116	
	6	Cloudy	S. W. 1	WSW.	30	04	112	
16.	12	Fair	S.W.2.		30	02	127	
	9	Cloudy			29	99	110	
	6	Fair	S. 2	S.b.w.	29	84	108	
17.	12	Hail						
	9				30	12	9	0 05
	6	ſmall Fr.	W. o.		30	19	78	
18.	12	Fair and	W. 2		30	2	11	
	9	pleaſant,			30	09	94	
	6		S.w.b.S3		29	88	98	
19.	12	Cloudy	S. w. 4.		29	77	115	
	9	Rain			29	60	103	
	6	Cloudy	Swb.w3		29	47	101	0 05
20.	12	Fair	W.b.S.4	w.S.w	29	54	118	
	9	Cloudy			29	48	100	
	6	Fair	S. W. 3	w.b. S.	29	38	95	
21.	12							
	9	Rain			29	49	96	0 25
	6	HoarFr.	W.S.W1		29	50	82	
22.	12	Fair	S. W. 2	w.	29	53	113	
	9	Cloudy			29	53	96	
	6		S.b.E 3	S.b.w.	29	40	101	
23.	12	Rain	S. 3		29	3	118	
	9				9	23	113	0 66
	6	Cloudy	S.b.w.2	S.S.w	29	07	103	0 57
24.	12	Fair	S. 4		29	06	119	
	9	Thunder			29	01	100	
	6	Rain	S. W. 3	w.	29	19	99	0 59
25.	12	Cloudy	W. 2.		29	31	117	
	9	Fair			29	38	94	
	6	Hoar F.	S. W. o		29	39	82	
26.	12	Fair	S.b.w2.		29	41	117	
	9	Rain			29	46	102	0 25
	6	Fair	S. o	w.S.w.	29	48	86	
27.	12	Rain &	S. o		29	50	121	
	9	Hail			29	54	98	0 41
	6	Rain	S.S.E.o		29	63	92	
28.	12		NN.w.1		29	71		
	9							
	6	Fair						
29.	12	Rain						
	9	Fair			29	33	96	0 10
	6	Cloudy	W.b.S.1	W.	29	30	93	
30.	12		WSW3.		29	23	112	
	9	Fair			29	20	96	
	6	Cloudy	w.N.w4		29	20	99	0 24
31.	12	Fair	NNW6		29	29	102	
	9	Rain	N. w. 2		29	43	96	
					Total.			5 63

APRIL. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
1.	6	Rain	W.b.N1	N. w.	29 37	93	
	12	and	N. 4		29 39	102	
	9	Hail			29 52	98	0 27
2.	6		N.N.W.3		29 50	92	
	12	ſame	N. 2		29 53	102	
	9		N.b.E.	N. E.	29 61	95	0 14
3.	6		N. 2.	N.E.b.E	29 63	88	
	12	Cloudy	NE.b.n3		29 67	08	
	9		N.b.E. 3	N E b.1	29 7	93	
4.	6	Fairer	N.b.E.3.	N. E.	29 85	90	
	12	Day.	N. E:4		29 90	107	
	9		Nb:E.2.		30 91	86	
5.	6	Froſt &	N b.E.2		29 8	8	
	12	Fair	N.E.2		29 75	09	
	9	Cloudy			29 6	95	
6.	6		E.b.N.0	N.	29 55	9	
	12	Cloudy	E S.E.1	S.	29 4	1 2	
	9				29 43	95	
7.	6	Cloudy	SE:b:E1	S. E.	9 37	85	
	12	Cold	E: 2:		9 3		
	9	Fair			9 28	98	
8.	6	Cloudy	N 2.		29 17	98	
	12	with ſome	N:b:W1		29 21	103	
	9	Drops			29 17	98	
9.	6	Cloudy	S. 0	N. W.	9 13	97	
	12		S. 1.	S. W.	29 15	115	
	9	Rain			9 16	97	0 52
10.	6	Fair	S:b:w:0	S. W.	9 23	93	
	12		S. 1		9 31	124	
	9	Cloudy			9 43	104	
11.	6		N. 1		29 46	99	
	12	Rain	N. 3.	N.N.E.	29 48		
	9				29 52	10	0 07
12.	6		N E.3		29 59	103	0 35
	12	Cloudy	N. E 4		29 70	113	
	9				29 83	95	
13.	6	Cloudy			29 90		
	12	Fair	N. E.				
	9	Cloudy			29 8	97	
14.	6	Cloudy	NEb.E.3		29 82	104	
	12	Fair	E.N:E:3	E.	29 83	12	
	9	Rain			29 7	108	0 12
15.	6	Cloudy	NEbN:1	E.	29 6	105	0 05
	12	Rain	S: W: 1	S: W.	29 61	118	
	9	Fairer			29 61	10	0 97
16.	6	Cloudy	S.b:w. 1		29 58	101	
	12		S. 1		9 5	129	
	9	Fair			29 6	103	
17.	6	Rain	W.S.W.		29 21	103	
	12						
	9	Fair.			9 25	99	0 21
18.	6	Hoar-F.	S:W:1		29 34	85	
	12	Fair					
	9	Rain	S. 1		29 34	100	
19.	6	Fairer	E:2		29 28	103	0 02
	12		W.b.N1		29 43	125	
	9	Cloudy			29 65	110	
20.	6	Hoar F.	N: 0		29 72	89	
	12	Fair					
	9				29 84	115	
21.	6	Cloudy	S.S.w.1	S. W.	29 87	110	
	12	warm &	S. W. 2		29 94	31	
	9	Fair			29 98	115	
22.	6	Cloudy	W.S.w0	W.	29 99	97	
	12		W.b:S 2		30 00	130	
	9	Fairer			29 97	110	
23.	6	Fair	s.w.b w2		9 96	104	
	12	and	W.S:w 3	N: W:	9 97	131	
	9	pleaſant			9 88	113	
24.	6		S: S.W.3	W.S.W.	29 74	109	
	12	Fair					
	9				29 60	110	
25.	6	Fair	s:w.b.w3	W.	29 64	102	
	12						
	9	Rain			29 37	105	
26.	6	Fair	s:w.b.w4	W.	29 12	109	0 71
	12		W. 4		29 15	123	
	9	Cloudy			29 14	100	
27.	6	Fair	S:W:1		29 23	91	
	12	Rain	W:b:S:1		29 31	124	
	9	Cloudy			29 41	105	0 01
28.	6	Fair	W.b.N1	N.b.w.	29 52	89	
	12	drops of	N. 2.		29 64	22	
	9	Rain	E: 1	E.b:N.	29 77	101	
29.	6	Hoar F.	N. E. 0		29 81	92	
	12	Fair	E: 1	N. b. E:	29 81	129	
	9	Cloudy	E. 0		29 79	104	
30.	6	Cloudy	E. 0	N b W.	29 78	06	
	12	Fair	S:b:W:1	N.w.b w	29 79	135	
	9	Cloudy	n:e.b.n0		9 8	17	
					Total:		3 44

MAY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
1.	6		W.b.S.1	N. w. .	29 84	112	
	12	Fair	N.W:1			138	
	9						
2.	6	Fair					
	12	Dry					
	9	Rain	S:b:w:3		29 65	113	
3.	6	Cloudy	sw:b:w:		29 47	120	0 34
	12		W.S.w.3		29 38	133	
	9	ſhowers	W. 3		29 35	106	0 19
4.	6	Fair	S. w. 1:		29 34	105	
	12						
	9	Rain			29 11	99	0 88
5.	6	Fair	W:b.S.2		29 17	90	
	12	Thund.	S: W: 1		29 31	118	
	9	Rain			29 40	98	0 29
6.	6	Hoar-Fr	S.S.w.1		29 51	92	0 08
	12	Fair	S. W. 3		29 58	121	
	9	ſhowers			29 69	107	0 01
7.	6		S:b:w:0.		29 79	98	
	12	Fair	S.b E. 2	S.	29 81	137	
	9				30 87	108	
8.	6		S. 1		29 90	102	
	12	Fair	S. 2		29 93	143	
	9						
9.	6	Fair.					
	12	and					
	9	warm	E: 1:		29 93	115	
10.	6		N. E:1		9 90	92	
	12	ſame	N. b.E.1		9 88	147	
	9				9 92	118	
11.	6		N.b.E. 3		30 00	117	
	12	ſame	N. 2.		30 10	150	
	9				30 21	108	
12	6	Fair	N:b:W2		30 17	105	
	12	and	N. 4.		30 14	132	
	9	Dry			30 10	108	
13.	6		N.b.E.3.		30 10	110	
	12	ſame	N.N.E4		30 08	137	
	9				30 06	109	
14.	6	Cloudy	N.N.E 2		30 05	110	
	12		Nb:E.2.		30 02	130	
	9	Fair	E: 1	N N.E	30 01	112	
15.	6		E.N.E.1	N. E.	29 99	110	
	12	ſame					
	9				29 92	100	
16.	6	Cloudy	NE.bE3	E. N. E.	29 88	108	
	12	Fair	E.N.E.3		29 87	131	
	9	Cloudy			29 83	110	
17.	6		E.N.E3		29 76	113	
	12	Cloudy	n:e.b.e.3		29 72	137	
	9				29 71	113	
18.	6	Fair	Ne.b.n2		29 69	115	
	12	and hot					
	9	Day			29 77	124	
19.	6		N. 2.	N: b:E.	29 80	113	
	12	Fair	n:e.b.e3		29 83	146	
	9		E:b:S:0		29 86	115	
20.	6		N. E. 2		29 86	110	
	12	ſame	E:b:S:2		29 86	143	
	9				29 83	110	
21.	6	Cloudy	N.n.e.1		29 80	112	
	12	hot and	E.b.N 2		29 76	148	
	9	Fair	N: E. 3		29 75	12[illegible]	
22.	6	Fair	N. E. 2		29 72	112	
	12	hot and					
	9	Dry			29 66	115	
23.	6	Cloudy	n:e:b.n1	N: b:E	29 66	109	
	12		E. 1	N.	29 59	134	
	9	Fair	E. 1	W.	29 49	145	
24.	6	Rain	N.N.E3	N. b: E.	29 43	117	
	12					113	
	9	Fair.			29 50	106	0 08
25.	6	Fair	N:n:w:2	N. b.W:	29 53	102	
	12	Hail	N.b.w.3		29 55	120	
	9	Fair	E.b:S 0		29 57	07	0 61
26.	6	Fair	E:b:S:1	N.b W.	29 55	04	
	12	Rain	S. W. 2	W.b.S.	29 57	32	
	9	Fairer	W: 0		29 62	113	0 1
27.	6	Fair	S:W:1		29 65	109	
	12	Cloudy	S:W:1	S.	29 67	40	
	9	Fair	S. 0		29 66	118	
28.	6	Fair	E: 1	S. E.	29 61	22	
	12	ſultry	E: 2	S.	29 57	50	
	9	Rain	E. 0	E.S.E.	29 58	31	
29.	6		E: 0	N.W.	29 63	124	0 05
	12						
	9						
30.	6						
	12						
	9						
31.	6	Hot and					
	12	Dry					
	9		W.b S:2		30 08	140	
					Total		2 67

JUNE. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther	Rain
1.	6	Very	S. w. 2	W.b S.	30 08	132	
	12	dry, hot					
	9	Day.			30 00	138	
2.	6	Fair	s.w.b.s.c	Sw.b.s.	29 91	132	
	12						
	9	Rain			29 85	134	0 01
3.	6		W: 2		29 90	123	
	12						
	9						
4.	6						
	12						
	9						
5.	6						
	12						0 01
	9						
6.	6	Fair					
	12	and					
	9	Dry.	W.b S.2		29 72	120	
7.	6		W.b.S:3.	W.b: N:	29 78	121	
	12		W: 2		29 82	142	
	9						
8.	6						
	12						
	9						
9.	6	great					
	12	drought.					
	9						
10.	6	Cloudy		N. W:			
	12		W.b.n.2.	W. b. n.	29 67	146	0 53
	9	Fair	W: 0		29 73	125	
11.	6	Fair	Wb.S.1		29 79	126	
	12	Hot					
	9	Cloudy	E. o		29 87	128	
12.	6	Hot and	E: 1	W:b:S:	29 86	138	
	12	very					
	9	Dry.	E. b S.o		29 81	136	
13.	6	Fair	E. 1		29 76	131	
	12		E.b.S.1.	*S.E.b.S.*	29 71	158	
	9	Rain	S. 1	S. b. E.	29 70	138	0 04
14.	6		S.s.w.3		29 86	126	
	12		S:b.w.4	s.w.b.s.	29 92	154	
	9						
15.	6						
	12						
	9						
16.	6						
	12						
	9						

D.	h	Weather.	Wind.	Clouds.	Barom.	Ther.	Rain
17.	6						
	12						
	9						
18.	6						
	12						
	9						
19.	6						
	12						
	9						
20.	6	Some					
	12	Cloudy	W.n:w1.		29 88	148	3 61
	9	ſome F.	w:n.w:o.	N.w b.n	29 92	128	
21.	6		W. o.	N:N: W	29 95	130	
	12		S. 1	N.w.	29 98	163	
	9						
22.	6						
	12						
	9						
23.	6	Fair					
	12	Hot	S. E. 1.		29 93	165	
	9	Day			29 93	141	
24.	6	Fair	S: E: 1		29 94	140	
	12	ſultry	N:b:w:1	W.	29 94	165	
	9	Rain	E. 1		29 93	140	0 20
25.	6	Fair	E. o.	w. b. n.	29 89	140	
	12	Hot	W.b S. 1		29 87	166	
	9	Day	s:w:b:w2		29 82	144	
26.	6		W. 2	w. b. n.	29 76	142	
	12	Fair					
	9		N.W.2.		29 84	134	
27.	6		N W. 2	N.w.b.n	29 98	130	
	12	ſame	S. 2.	N.	30 01	158	
	9				29 96	135	
28.	6		W.S.w.2	W.	29 90	133	
	12	ſame	W.N.w2	W.	29 91	161	
	9				29 92	125	
29.	6		W.N.w2		29 96	118	
	12	ſame	W.b.S. 1		29 99	143	
	9				29 99	135	
30.	6		N.w.b.w.1	N. w.	29 99	135	
	12	ſame	N.w.b.w.3		29 97	162	
	9		E. 1.	N.	30 97	130	
					Total		4 40

MAY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	6		W.b.S.1	N, w..	29 84	112	
1.	12	Fair	N.W:1			138	
	9						
	6	Fair					
2.	12	Dry					
	9	Rain	S:b:w:3.		29 65	113	
	6	Cloudy	sw:b:w:		29 47	.20	0 34
3.	12		W.S.w.3		29 38	133	
	9	ſhowers	W. 3		29 35	.06	0 19
	6	Fair	S. w. 1:		29 34	.05	
4.	12						
	9	Rain			29 11	99	0 88
	6	Fair	W:b.S.2		29 17	90	
5.	12	Thund.	S: W: 1		29 31	118	
	9	Rain			29 40	98	0 29
	6	Hoar-Fr	S.S.w.1		29 51	92	0 08
6.	12	Fair	S. W. 3		29 58	121	
	9	ſhowers			29 69	107	0 01
	6		S:b:w:o.		29 79	98	
7.	12	Fair	S.b E. 2	S.	29 81	137	
	9				30 87	106	
	6		S. 1		29 90	102	
8.	12	Fair	S. 2		29 93	143	
	9						
	6	Fair.					
9.	12	and					
	9	warm	E: 1:		29 93	115	
	6		N.:E:1		9 90	92	
10.	12	ſame	N.b.E.1		9 88	:47	
	9				9 92	118	
	6		N.b.E 3		30 00	117	
11.	12	ſame	N. 2.		30 10	150	
	9				30 21	108	
	6	Fair	N:b:W2		30 17	105	
12.	12	and	N. 4.		30 14	132	
	9	Dry			30 10	108	
	6		N.b.E.3.		30 10	110	
13.	12	ſame	N.N.E4		30 08	137	
	9				30 06	109	
	6	Cloudy	N.N.E2		30 05	110	
14.	12		Nb:E.2.		30 02	130	
	9	Fair	E: 1	N N.E	30 01	112	
	6		E.N.E.1	N. E.	29 99	110	
15.	12	ſame					
	9				29 92	100	
	6	Cloudy	NE.bE3	E. N.E.	29 88	105	
16.	12	Fair	E.N.E.3		29 87	131	
	9	Cloudy			29 83	110	
	6		E.N.E3		29 76	113	
17.	12	Cloudy	n:e.b.e.3		29 72	137	
	9				29 71	113	
	6	Fair	Ne.b.n2		29 69	115	
18.	12	and hot					
	9	Day			29 77	124	
	6		N. 2.	N:b:E.	29 80	113	
19.	12	Fair	n:e.b.e3		29 83	146	
	9		E:b:S:o		29 86	115	
	6		N. E. 2		29 86	110	
20.	12	ſame	E:b:S:2		29 86	143	
	9				29 83	110	
	6	Cloudy	N.n.e.1		29 80	112	
21.	12	hot and	E.b.N 2		29 76	148	
	9	Fair	N: E.3		29 75	12[illegible]	
	6	Fair	N. E. 2		29 72	112	
22.	12	hot and					
	9	Dry			29 66	115	
	6	Cloudy	n:e:b.n1	N: b:E	29 66	109	
23.	12		E. 1	N.	29 59	134	
	9	Fair	E. 1	W.	29 49	145	
	6	Rain	N.N.E3	N. b: E.	29 43	117	
24.	12					113	
	9	Fair.			29 50	106	0 08
	6	Fair	N:n:w:2	N. b.W:	29 53	102	
25.	12	Hail	N.b.w.3		29 55	12[illegible]	
	9	Fair	E.b:S o		29 57	.07	0 61
	6	Fair	E:b:S:1	N.b W.	29 55	04	
26.	12	Rain	S. W. 2	W.b.S.	29 57	32	
	9	Fairer	W: o		29 62	113	0 10
	6	Fair	S:W:1		29 65	109	
27.	12	Cloudy	S:W:1	S.	29 67	40	
	9	Fair	S. o		29 66	118	
	6	Fair	E: 1	S. E.	29 61	22	
28.	12	ſultry	E: 2	S.	29 57	50	
	9	Rain	E. o	E.S.E.	29 58	31	
	6		E: o	N.W.	29 63	.24	0 09
29.	12						
	9						
	6						
30.	12						
	9						
	6	Hot and					
31.	12	Dry					
	9		W.b S:2		30 08	140	
					Total		2 67

JUNE. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain
	6	Very	S. w. 2	W.b S.	30 08	132	
1.	12	dry, hot					
	9	Day.			30 00	138	
	6	Fair	s.w.b.s.c	Sw.b.s.	29 91	132	
2.	12						
	9	Rain			29 85	134	0 01
	6		W: 2		29 90	123	
3.	12						
	9						
	6						
4.	12						
	9						
	6						
5.	12						
	9						0 01
	6	Fair					
6.	12	and					
	9	Dry.	W.b S.2		29 72	120	
	6		W.b.S:3.	W.b: N:	29 78	121	
7.	12		W: 2		29 82	142	
	9						
	6						
8.	12						
	9						
	6	great					
9.	12	drought.					
	9						
	6	Cloudy		N. W:			
10.	12		W.b.n.2.	W. b. n.	29 67	146	0 53
	9	Fair	W: o		29 73	125	
	6	Fair	Wb.S.1		29 79	126	
11.	12	Hot					
	9	Cloudy	E. o		29 87	128	
	6	Hot and	E: 1	W:b:S:	29 86	138	
12.	12	very					
	9	Dry.	E. b S.o		29 81	136	
	6	Fair	E. 1		29 76	131	
13.	12		E.b.S.1.	*S.E.b.S.*	29 71	158	
	9	Rain	S. 1	S. b. E.	29 70	138	0 04
	6		S.s.w.3		29 86	126	
14.	12		S:b.w.4	s.w.b.s.	29 92	154	
	9						
	6						
15.	12						
	9						
	6						
16.	12						
	9						
	6						
17.	12						
	9						
	6						
18.	12						
	9						
	6						
19.	12						
	9						
	6	Some					
20.	12	Cloudy	W.n:w1.		29 88	148	3 61
	9	ſome F.	w:n.w:o.	N.w b.n	29 92	128	
	6		W. o.	N:N: W	29 95	130	
21.	12		S. 1	N.w.	29 98	163	
	9						
	6						
22.	12						
	9						
	6	Fair					
23.	12	Hot	S. E. 1.		29 93	165	
	9	Day			29 93	141	
	6	Fair	S: E: 1		29 94	140	
24.	12	ſultry	N:b:w:1	W.	29 94	165	
	9	Rain	E. 1		29 93	140	0 20
	6	Fair	E. o.	w. b. n.	29 89	140	
25.	12	Hot	W.b S. 1		29 87	166	
	9	Day	s:w:b:w2		29 82	144	
	6		W. 2	w. b. n.	29 76	142	
26.	12	Fair					
	9		N.W.2.		29 84	134	
	6		N W. 2	N.w.b.n	29 98	130	
27.	12	ſame	S. 2.	N.	30 01	158	
	9				29 96	135	
	6		W.S.w.2	W.	29 90	133	
28.	12	ſame	W.N.w2	W.	29 91	161	
	9				29 92	125	
	6		W.N.w2		29 96	118	
29.	12	ſame	W.b.S. 1		29 99	143	
	9				29 99	135	
	6		N.w.b.w.1	N. w.	29 99	135	
30.	12	ſame	N.w.b.w.3		29 97	162	
	9		E. 1.	N.	30 97	130	
					Total		4 40

JULY. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther	Rain
1.	6	Miſling	n.e.b.e.1		30 00	134	
	12	Hot and	E:S:E: 2	N.	30 00	150	
	9	Fair			29 97	122	
2.	6	Fair	E:S:E: 1		29 96	125	
	12	and	N E.2		29 92	150	
	9	Hot			29 87	124	
3.	6		E: 1		29 83	131	
	12	ſame	E. 2		29 82	157	
	9				29 78	129	
4.	6	Fair	E.b.N.1		29 74	120	
	12	Cloudy					
	9	Fair	n.e.b.n.1		29 80	135	
5.	6	Fair	N. 2		29 85	123	
	12		N: 2	N.N:E:	29 87	150	
	9	Cloudy			29 90	125	
6.	6		N:b:E.1		29 90	120	
	12	Cloudy	N.NE.2		29 90	143	
	9				29 86	115	
7.	6		n:e:b:no	E.b.N.	29 84	120	
	12	Fair	E. 1.		29 81	147	
	9				29 78	125	
8.	6	Fair	E.b S.1		29 79	116	
	12	and	W.Nw.	W.b.N.	29 82	165	
	9	Hot	n.w.b no		29 90	143	
9.	6		N:b.W1		30 01	132	
	12	ſame	nw.b.w1	N. W.	30 03	153	
	9				30 04	131	
10.	6				30 01	119	
	12	ſame					
	9		W:		29 88	147	
11.	6	Hot and	W.b.S.2		29 89	140	
	12	Dry.	W.b.n.2.	N. W:	29 89	162	
	9				29 92	143	
12.	6	ſultry	E:b:N:0		29 97	140	
	12	Hot	E:N:E:1		29 97	178	
	9	Cloudy			29 97	143	
13.	6	Very	E.b.S:0		29 96	133	
	12	Hot and	E.S.E:1	S. b. E.	29 97	173	
	9	dry			29 90	142	
14.	6	ſultry	E 1		29 87	136	
	12	Rain &	E:b:S:2	E.b N:	29 88	164	
	9	Thund.			29 91	139	0 64
15.	6	Cloudy	n:e:b:n.2		29 93	136	
	12	Fair &	N.E.3		29 90	164	
	9	Dry.			29 87	136	
16.	6	Fair	N:E:2		29 87	140	
	12	Hot and	E: 2	N: E.	29 88	172	
	9	Dry.			29 89	134	
17.	6		E b.N.0		29 91	138	
	12	ſame	E.b.N.2		29 93	167	
	9				29 99	131	
18.	6	Cloudy	N.b.E:3		30 03	130	
	12	Cool	N. 2		30 06	142	
	9	Day			30 06	127	
19.	6		N. 2		30 01	126	
	12	ſame	N. 1		29 98	138	
	9	Rain			29 92	123	
20.	6	Cloudy	N.N.W2		29 86	115	
	12	and	n.w b.n2		29 86	139	
	9	Cool			29 86	126	0 0
21.	6	Cloudy	N.N.W1		29 87	126	
	12		N:N:W1	N:N:E.	29 87	155	
	9	Fair	S. 1		29 83	134	
22.	6	Fair	W.b S.1		29 81	122	
	12		N:w . 1		29 80	159	
	9	Cloudy	S: E: 0		29 78	135	
23.	6	Fair	S. E. 1.		29 78	131	
	12	Some	S. 2.		29 74	172	
	9	Drops			29 73	139	
24.	6	Fair	S.W.1		29 71	128	
	12	Rain	S W:2	W.	29 67	160	
	9	Fair			29 58	129	0 01
25.	6		S:S:E.1	S.	29 37	129	
	12	Rain			29 21		
	9		S. 1		29 17	129	1 8
26.	6	Fairer	S. 1	S. W.	29 21	118	
	12	Rain		S.S.W.	29 24	156	
	9	Fair	S. 2		29 25	129	0 2
27.	6		S. b. W.2	S.W.b.S	29 11	128	
	12	ſame	S. 4	S.S.W.		153	
	9				29 18	128	0 2
28.	6	Fair	S. 1		29 24	125	
	12		S.w.4	S.S.W.	29 27	147	
	9	Rain			29 28	129	0 3
29.	6	Fair	S.b.W.3		29 30	129	
	12	Rain	S:w:b:s4	S. W.	29 29	148	
	9	Thund.			29 35	124	2 2
30.	6		S:w:b.s3	S. W.	29 38	122	
	12	Fairer	S. W. 4		29 42	149	
	9				29 46	128	
31.	6	Rain	S:S:E:1	S: b. W	29 36	126	1
	12		S. 4		29 34	144	
	9	Fair			29 36	127	
					Total		6 6

AUGUST 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther	Rain
	6	Fair	S b.W.4	S.S.W.	29 32	128	
1.	12	Rain	S.w.b.s.4		29 33	145	
	9	Cloudy	S. W. 8		29 36	130	0 07
	6	Fair	W.b.S.1		29 62	118	
2.	12		W.S.w1	W. b. S.	29 70	142	
	9	Cloudy			29 63	131	
	6	Cloudy	NN.w.1	W.S.W.	29 56	123	
3.	12						
	9	Fair			29 72	117	
	6	Cloudy	NNwo	W. b: S.	29 75	105	
4.	12	Fair	E:b:S:2	W:b:N.	29 71	147	
	9	Rain			29 50	123	
	6	Rain	E.b.S.o	S.W.b.S.	29 37	125	4 38
5.	12		S. W. 1.	W.	29 31	139	
	9	Fairer			29 63	127	0 46
	6		S. o.		29 67	125	
6.	12	Showry	S. 2		29 59	139	
	9				29 50	139	0 08
	6	Fairer	S.W.4.		29 39		
7.	12						
	9	Rain			29 32	126	
	6	Fair	S. W 4		29 30	118	0 75
8.	12		S. W. 3.		29 33	141	
	9	Rain			29 55	117	0 66
	6		S W:2	W.S.W.	29 63	116	
9.	12	Fairer	Swbw.3.		29 66	145	
	9				29 69	125	
	6	Fair	SWbS3.		29 70	119	
10.	12		S.W. 3.		29 72	150	
	9	Cloudy			29 72	131	
	6	Fair	S. 1.	S. S. W.	29 65	116	
11.	12		. 3.		29 58	152	
	9	Cloudy			29 43	137	
	6	Rain	N.W.1.	W. b. S	29 49	117	
12.	12	Fair	WbN3.		29 57	140	
	9				29 65	120	0 44
	6	Cloudy.	S.S.w.3.	N. W.	29 67	120	
13.	12						
	9	Rain			29 65	132	
	6	Cloudy	S. W. 2		29 61	131	0 17
14.	12		W.b.S. 2	N. W:	29 69	153	
	9	Fair			29 73	134	
	6	Fair	W.S.w2.	W. b. S.	29 73	139	
15.	12		W. S. w3		9 72	158	
	9	Rain			29 75	122	0 44
	6		N.W. 1		29 87	110	
16.	12	Fair	NwbN2		9 98	132	
	9				30 00	111	
	6	Fair	N.N w1		29 98	108	
17.	12						
	9	Cloudy			30 00	116	
	6		N.b.w.1		30 01	11	
18.	12	Cloudy	N. 2	N.N.E.	30 03	138	
	9				30 02	115	
	6		N. 2		29 97	116	
19.	12	Cloudy	N.b.E:2	N.N.E.	29 92	142	
	9				29 87	124	
	6	Cloudy	NNE.1		29 82	115	
20.	12	Fairer	NEbN2		29 80	140	
	9	Cloudy			29 76	127	
	6		N. E. 1.	E:b:N	29 70	117	
21.	12	Fairer					
	9				29 56	129	
	6	Mist	NNE.o.		29 50	126	
22.	12		W.b.N1		29 53	15	
	9	Fair			29 59	122	
	6	Misty	S.b w:o	S.	29 63	118	
23.	12	Fair	S: 2.		29 64		
	9	Cloudy			29 56	128	
	6	Rain	S: 1	S.b.W.	29 47	129	0 24
24.	12	Cloudy	S. b.W.3		29 43	148	
	9	Rain			29 37	127	0 21
	6	Cloudy	S.W.1	W.	29 41	119	
25.	12		S. W. 3		29 53	149	
	9	Fair			29 64	124	
	6	Fair	S.w. 1	W.b.S.	29 71	116	
26.	12		S:b:E:2.		29 68	137	
	9	Rain			29 63	136	0 58
	6	Fair	s.w.b:s:2		29 67	120	
27.	12		S:w:b:s3		29 65	143	
	9	Cloudy	S: 4	S. S. W.	29 45	128	
	6		S: w. 5	S.w.b w.	29 48	118	
28.	12	Fair	W:b:s:5	W:N.w.	29 59	14	
	9		W: S.w1	W.	29 80	117	
	6	Fair	S: W. o	W.	29 8	112	
29.	12						
	9	Rain	S. W. 1.		29 89	129	0 12
	6		S.S:w:2	S. W.	29 89	121	
30.	12	Fair	S.S.w:2.	S.	29 89	150	
	9				29 78	121	
	6	Fair	E. 1		29 6	115	0 01
31.	12						
	9	Rain	W. 2		29 73	129	
					Total		8 57

SEPTEMBER: 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.		Ther.	Rain
1.	6	M·ſt.	S.W. 0		29	84	98	
	12		s.w.b.s.2	S.	29	85	145	
	9	Fair	S. 0.		29	80	122	
2.	6		S:E: 0	S.b.E.	29	77	112	
	12	Cloudy						
	9				29	77	130	
3.	6		S.S.E.0	*S.*	29	67	122	
	12	ſame	N.W.2	*N.W.*b.N	29	65	144	
	9				29	72	120	
4.	6		n.e.b.n.1	*S.S.E.*	29	90	108	
	12	Fair	N: 2	*N* b.*W.*	29	18	138	
	9				30	12	115	
5.	6	Miſt	N. 0	E.	30	17	96	
	12		E. 1.		30	18	39	
	9	Fairer			30	15	112	
6.	6	Miſt	E: 0		30	07	92	
	12		E.S.E:1	E.	30	03	142	
	9	Fair			30	01	115	
7.	6	Miſt	E. 0		30	03	97	
	12	Fair	N:E:2	*N N:E:*	30	06	147	
	9	Cloudy			30	15	131	
8.	6	Miſling	N:b:E.		30	21	123	
	12	Fair	E:N.E:	*N: E.*	30	22	137	
	9	Cloudy			30	22	121	
9.	6		N. 1.	N.E.bN	30	18	116	
	12	Fair						
	9				30	12	115	
10.	6		E. 0		30	10	97	
	12	Fair	E. 2		30	08	142	
	9				30	05	121	
11.	6	Miſt	E. 0		29	95	110	
	12		E. 1		29	94	150	
	9	Fair			29	91	121	
12.	6		E. 0		29	89	102	
	12	ſame	E. 1		29	90	152	
	9				29	90	127	
13.	6	Miſt,	E. 0		29	91	114	
	12	ſomewh.	E:b.N:1	E.	29	93	143	
	9	Cloudy			29	93	129	
14.	6	Miſty	E. 0		29	89	126	
	12	leſs						
	9	Cloudy			29	89	127	
15.	6		S.W. 1	S.w.b.w:	29	91	122	
	12	ſame						
	9	very dry			29	93	134	
16.	6	Rain	s.w.b.s 0		29	91	128	
	12		S.S.w.1		29	92	140	
	9	Cloudy			29	81	122	0 15
17.	6		E. 0		29	59	112	
	12	Rain	S.W.1		29	50	141	
	9				29	60	116	2 36
18.	6		W.b.S. 2	N. W.	29	82	102	
	12	Fair	*W.N.W.*2		29	88		
	9				29	91	106	
19.	6	Rain	S:S:w.2	W.	29	80	115	
	12							
	9	Cloudy			29	65	130	0 10
20.	6	Rain	S. b.W.3		29	41	127	
	12		S:w:b:s4	S.b.*W.*	29	42	125	
	9	Cloudy			29	36	115	0 34
21.	6	Fair	W.S.w:3		29	44	106	
	12	Cloudy	S.b.W.4	W.	29	46	132	
	9	Rain			29	38	116	0 16
22.	6	Fairer	S. W. 3		29	14	112	2 57
	12	Rain	sw:b.w4		29	21	128	
	9	ſtormy			29	21	116	1 10
23.	6	Fair	S.W:3		29	05	103	0 27
	12	Cloudy	s.w.b:s:9		29	07	122	
	9	Rain			29	95	102	
24.	6	Fairer	W.b.s.2	N:N:w:	29	08	100	0 77
	12		W:b:s:3	W.b.N.	29	26	121	
	9	Rain			29	51	100	1 07
25.	6		W:b:s:1		29	75	88	
	12	Fair						
	9				30	00	101	
26.	6	Miſling	S.w. 1		30	04	102	0 0
	12		*W:N:W*1	N.b.W.	30	10	130	
	9	Cloudy	N.b.w:0		30	18	121	
27.	6		E:S:E:0	E.N.E.	30	21	112	
	12	Fair	E.b.S.2		30	23	123	
	9				30	23	101	
28.	6	Fair	*N.*b.*W:*1		30	16	100	
	12	ſmall	N.b.E 2		30	12	130	
	9	Rain			30	08	117	
29.	6		E. 0	E.N.E.	30	12	117	
	12	Fair	E.b N.2		30	12	135	
	9		E.N.E3		30	11	122	0 2
30.	6		E.b.N.3		30	08	122	
	12	Cloudy	E. 3.	E:b:N.	30	10	127	
	9		E:b:N.3		30	08	123	
					Total			8 0

OCTOBER. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom	Ther.	Rain.
	6	Fairer	E.b.N.1	E.	29 97	122	
1.	12		E. 2		29 93	132	
	9	Cloudy			29 93	123	
	6	Rain	E.b.N.2		29 87	118	
2.	12	Fairer	E.b.N.1		29 80	131	
	9	Rain			29 73	111	1 45
	6	Fairer	E.b.S.1.	S. S. W.	29 66	115	1 92
3.	12	Cloudy	S. W. 2		29 67	128	
	9				29 73	118	
	6		S. W. 0		29 79	108	
4.	12						
	9						
	6	Cloudy					
5.	12						
	9	Fair			29 98	96	
	6	Hoar Fr.	NN.w.1		30 12	87	
6.	12	and	N. 1.		30 17	112	
	9	Fair			30 22	89	
	6		N. W. 0		30 18	99	
7.	12	Cloudy	W.bN. 1		30 19		
	9	Rain			30 20	96	
	6		NEbN1		30 21	105	0 07
8.	12	Cloudy	E.b.N.1		30 20	119	
	9				30 16	110	
	6		E. 0		30 07	106	
9.	12	Same	E.b.N.2		30 06	119	
	9				30 01	99	
	6	Miſt	E.b.N.0		29 92	92	
10.	12						
	9	Fair			29 85	104	
	6	Miſt	E. 1		29 80	99	
11.	12	Cloudy					
	9	Miſling			29 80	120	
	6	Miſt	SEbE.0.		29 75	109	0 42
12.	12	Warm	S. 2.		29 77	140	
	9	Fair			29 79	115	
	6	Cloudy	S. 0.	S. b. W	29 77	106	
13.	12	and	SWbS.3		29 79	136	
	9	Warm			29 87	119	
	6		S.b.E.2		29 87	119	
14.	12	Same	S. 2.		29 81	133	
	9				29 65	122	
	6	Cloudy	S. 3	S. S. w.	29 57	129	
15.	12	Miſling	S. 2		29 57	136	
	9	Rain			29 54	127	
	6		E.S.E.2.	S.E.b. S	29 52	122	
16.	12	Rain	S. E. 1	S. b. E	29 48	30	
	9				29 50	122	0 64
	6		E. 1	S. E.	29 50	117	
17.	12	Fair	E. 1	S.E.b.E.	29 56	130	
	9				29 61	111	
	6		N. E. 2		29 65	118	
18.	12	Cloudy	E.b.N.1		29 65		
	9				29 66	119	
	6		N. E. 2		29 68	116	
19.	12	Same	E.b.N.3		29 71	23	
	9				29 74	114	
	6	Cloudy	E. 3		29 75	111	
20.	12	and	E.b.N.3		29 80	111	
	9	Cool			29 85	39	
	6		E. 1		29 89	79	
21.	12	Firſt Ice	E. 3		29 92	120	
	9				29 93	83	
	6	Froſt	E.0		29 91	73	
22.	12	and	E.b.S.1		29 91	98	
	9	Fair			29 87	79	
	6		E. 0		29 77	70	
23.	12	Same	E.b.S.2.	E.	29 77	101	
	9				29 70	82	
	6	Cloudy	E. 1.	S. W.	29 51	85	
24.	12		S. E. 3.	S.W.b.S	29 32	111	
	9	Rain			29 07	109	1 95
	6	Fair	S. W. 3		29 18	94	1 04
25.	12	Cloudy					
	9	Rain			29 16	96	
	6		W. 1	NWbN	29 18	92	0 90
26.	12	Fair	N.b.w.3	N. w.	29 32	110	
	9		w. Nw.0		29 51	88	
	6	Froſt	w.S.w.0		29 51	82	
27.	12		S. 3		29 42	107	
	9	Cloudy	S. W. 1.		29 43	111	
	6	Cloudy	S W. 0		29 51	100	
28.	12		S.wb.S 1		29 51	114	
	9	Rain	E.S.E 2		29 28	110	1 24
	6		S. 3.		29 08	117	0 31
29.	12	Rain	S S.E. 2.	S.	29 03	122	
	9		W Nw3		29 16	96	0 43
	6		S.w.bw2		29 48	89	
30	12	Fair					
	9				29 48	109	
	6	Cloudy	S. 4.	S. W.	26 36	115	3 12
31.	12						
	9	Rain			26 14	113	
					Total		13 49

NOVEMBER. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom.	Ther.	Rain.
	8		W. 3	W.S.W.	29 29	95	
1.	12	Fair	W.b.N4		29 42	103	
	9	Rain			29 67	99	
	8		s:w.b.wo	V. b: S.	29 80	106	0 28
2.	12	Fair	S.b:w:2	S. W.	29 85	116	
	9	Cloudy			9 84	109	
	8	Fairer	S. 3		29 53	105	
3.	12		S. 6	S. b: W.	29 52	119	
	9	Rain			29 60	102	0 36
	8		S: W: 3	W.S. W.	29 85	96	
4.	12	Fairer			29 92	112	
	9				29 95	111	
	8	Fair	S:W: 3	N.N.w.	29 98	107	
5.	12	Cloudy	S. W. 2	W.	30 01	120	
	9	Fair			30 03	112	
	8		S.S E.o		30 02	100	
6.	12	Fair	S.S.E.1	S.	30 02	115	
	9				29 97	97	
	8	Miſty	S: S.W.2		30 02	110	
7.	12						
	9	Fair			30 22	94	
	8		W. 0		30 27	8	
8.	12	Miſt	W. 1		30 27	98	
	9				30 30	101	
	8		S:b:E1		30 29	100	
9.	12	Cloudy	S. E. 1		30 28	107	
	9				30 22	87	
	8	Froſt &	E: 1:		30 16	80	
10.	12	Fair	E. 1		30 18	103	
	9				30 27	92	
	8		N. o		30 31	87	
11.	12	Foggy	N.b.E. o		30 31	10.	
	9				30 33	96	
	8	Miſt	N.N.E o	s.w.b.s.	30 30	94	
12.	12		E.b.N. o	s:w.b:w.	30 30	104	
	9	Cloudy			30 23	103	
	8	Cloudy	S. W. 1	W.b.N.	30 09	103	
13.	12	Fair	S. W. 3		30 03	110	
	9	Cloudy			29 85	109	
	8	Fair	W.S.w1		29 76	103	0 29
14.	12		W.S:w 4	N. W.	29 70	110	
	9	Stormy	w.s.w.8		29 35	114	
	8	Cloudy	W: 6	N. w.	9 53	109	
15.	12		W:b:N5	N. w.	29 63	115	
	9	Fair			9 84	94	
	8		W.b:S.1	W:N:W:	29 87	89	
16.	12	Fair	W.s.w.2	W.	29 88	105	
	9				29 8	113	
	8		N. w. 3	W.	29 86	103	
17.	12	Fair	W. 1		29 93	105	
	9				29 91	85	
	8	Froſt	n. s. w.3		29 81	92	
18.	12		n. s. w.3		29 87	107	
	9	Fair			29 94	94	
	8	Froſt	S:b:W.o	N. w.	29 94	79	
19.	12	and	S. 1		29 94	97	
	9	Fair			29 91	92	
	8		S: 1	S.W.	29 85	88	
20.	12	Same	S.w.b.s.2		29 85	106	
	9				29 86	109	
	8	Cloudy	s.w.b.s.2	W. s. w:	29 84	112	0 05
21.	12	Mild	S.w.b.s.3	W. b. S.	29 82	122	
	9	Fair			29 78	112	
	8	Rain	W: o	N.w.bw	29 75	103	0 45
22.	12	Fair	N. 1		29 83		
	9				29 89	85	
	8	Froſt	N: W: o	N. b. E:	29 89	80	
23.	12	and.	N. w. o		29 90	91	
	9	Fair			29 92	75	
	8	Froſt	N: w: o		29 86	71	
24.	12	and.	N w. 1		29 85	90	
	9	Cloudy	S. w. 1.		29 83	95	
	8	Cloudy	S:W:o		29 76	89	
25.	12						
	9						
	8						
26.	12	Rain					
	9						
	8	Froſt					
27.	12	and					
	9	Fair					
	8						
28.	12	Hard-Fr					
	9						
	8						
29.	12	Snow					
	9						
	8	Snow					
30.	12						
	9	Fairer	N.b.E.2		29 60	60	0 59
					Total		1 9

DECEMBER. 1699.

D.	h.	Weather.	Winds.	Clouds.	Barom	Ther.	Rain
	8	Cloudy	N.N.wo		29 71	73	
1.	12	Hard Fr.	N. W. o		29 71	76	
	9	Fairer			29 58	60	
	8	Froſt	E.b.S.3.		29 30	78	
2.	12	Cloudy	E. 4		29 12	82	
	9	Snow			28 91	83	
	8		E 3		28 61	91	0 56
3.	12	Rain	E.b.S.3		28 52	94	
	9				28 44	100	
	8	Cloudy	E S.E 3	S.S.E.	28 60	98	0 18
4.	12	Fair					
	9	Rain			28 74	9[illegible]	
	8		S:b:E.o	S. b. W.	29 01	9[illegible]	0 13
5.	12	Fair	S. 2.	S. S. W.	29 14	110	
	9	Rain			29 28	103	
	8	Fair-	S. 2.		29 26	107	0 74
6.	12	Rain &	S.b.E.3	S. b. w.	29 32	115	
	9	Warm.			29 39	108	
	8	Cloudy	S. 1.		29 50	106	0 36
7.	12	and			29 48	112	
	9	Warm			29 48	105	
	8	Cloudy	S.S.E.1	S.b.E.	29 37	109	
8.	12	Miſling	S:S:E.3		29 32	116	
	9	warm			29 36	114	
	8		S. E. 3.		29 1[illegible]	113	
9.	12	Rain	S. S. E.3		29 19	117	
	9				29 29	112	0 38
	8		S. b. E.1		29 41	102	
10.	12	Fair	S.b.E.2		9 46	112	
	9				29 57	98	
	8	Fair	S. W. o		29 88	92	0 05
11.	12	Cloudy					
	9	Rain			29 95	108	
	8	Cloudy	S.b.E.2	S. b. w.	29 84	109	0 36
12.	12	& ſome	S. 1.	S: w.	29 76	115	
	9	Rain			29 73	108	
	8	Cloudy	S. W. 3		29 54	110	0 61
13.	12		s:w:b.w		29 57	112	
	9	Fair			29 63	104	
	8		S. W. 1	W:b:S:	29 51	102	0 21
14.	12	Rain	W.b.s.1		29 43	108	
	9				29 48	98	
	8	Fair	w.b.N.2	N.N.w.	29 64	100	
15.	12		NN.w.1		29 69	103	
	9	Cloudy			29 91	9[illegible]	
	8	Miſling	N.N.w1		30 07	95	
16.	12		N. 1.		30 14	101	
	9	Fair			30 27	87	
	8	Froſt &	N. o		30 25	73	
17.	12	Fair	S. W. 1.		30 20	88	
	9	Rain			30 33	90	0 29
	8	Froſt	N. w. 1		30 44	82	
18.	12	Hazy					
	9	Fair			30 35	76	
	8	Cloudy	W. 1	N. w.	30 21	81	
19.	12	with	N. w. 1		30 2[illegible]	9[illegible]	
	9	Thaw			30 23	91	
	8	Cloudy	N. w. o	N.	30 26	86	
20.	12		N. w. 1		30 27	102	
	9	Fair	W Nw. o		30 31	94	
	8	Miſling	N.b.w. o		30 36	90	
21.	12		N.b.E.1		30 40	99	
	9	Fairer			30 47	94	0 03
	8	Miſling	N. o	N. E.	30 50	89	
22.	12		N. 1		30 49	92	
	9	Cloudy			30 46	85	0 07
	8	Froſt	N.b.w.o		30 40	74	
23.	12	Fog	N. o		30 38	88	
	9	Cloudy	S.b. E.		30 15	86	
	8		S W. o		30 21	86	
24.	12	Cloudy	S.wb.S 2		30 19	94	
	9		S S.w.1.		30 15	91	
	8	Fairer	S.S.w.1		30 14	98	
25.	12		s.w.b.w1		30 12	102	
	9	Rain	S.b.w.1		29 98	102	
	8	Cloudy	W. o	N.W.o	29 96	107	0 68
26.	12		W. 1.	N. w.	30 06	105	
	9	Fair			30 10	94	
	8		W.b.s.2	N.N.w.	29 95	86	
27.	12	Fair	N.w.2		29 94	98	
	9		W.b:No	N. b. w.	29 94	91	
	8	Fog	W.b.No		29 90	94	
28.	12	Miſling	W.b:S.o	n.w.b.w	29 86	1[illegible]8	
	9	Rain			29 80	106	0 27
	8		W.b.N2		29 72	96	0 58
29.	12	Fair	N. w. 4		29 83	100	
	9				30 03	82	
	8	Froſt	S. w. 2		30 01	89	
30.	12	Cloudy	S. W. 3	W. b. S.	29 96	[illegible]4	
	9	Rain			29 94	105	0 2[illegible]
	8	Fairer	S. w. 3		29 93	110	0 0[illegible]
31.	12		S. w. 3		29 92	112	
	9	Cloudy			29 95	108	
					Total.		5 77

In theſe Tables, I have never ſet down the *Flying of the Clouds*, but when they varied from the Winds; which oftentimes happens, eſpecially before n.249.p.46. the wind ſhifteth its Courſe. Mountains, &c. may cauſe ſome Variation, but as little at *Upminſter*, as almoſt any where. This laſt Column will be neceſſary, amongſt other Uſes, to ſhew the Reaſon why the *Mercury* varies ſometimes: As ſuppoſe the Wind was in the Southerly Points, and the Clouds flew from the Northerly; the Riſing of the Mercury would be readily accounted for.

My *Thermometer* is graduated by Inches and decimal Parts. The Point of n.262.p.527. Freezing is about 80, or at moſt 82 Degrees, and conſequently 'tis cold at about 90, and temperate at about 100 Degrees. I need not ſay, that the Degrees above 100 are warm or hot; and thoſe below 80 are harder Froſts. The Degrees of my *Thermometer* reach to 240, although I could never make the Spirits deſcend with artificial Freezing, much lower than 50, neither when expoſed to the Heat of a pretty ſtrong Sun, did they aſcend above 225. It is placed in the open Air, and always defended from the Beams of the Sun. So that it ſheweth only the true preſent Temperature of the Air.

The Winter has been ſo mild (as appears by the *Thermometer*) that many of the Days of *Nov.* and *Dec.* were not much colder than many of the Mornings and Evenings of the warmer Months. Theſe two laſt Months have been alſo much drier than uſual, ſo that had it not been for the Rains of *Oct.* perhaps a Drought had been a general Calamity.

I have had frequent Confirmations of what I obſerved laſt year, concerning the Mercury riſing in Foggy Weather. The like it doth alſo in miſling Weather; as may be ſeen in divers places of this Table. Particularly *Dec:* 22. The Weather being miſling, and Wind Northerly, it aſcended to 30,50 Inches, the higheſt I ever ſaw at *Upminſter*.

XXVIII. 1. *Octob.* 30. 1669 Between 5 and 6 of the Clock in the Evening, the Wind weſterly, at *Aſhley* in *Northamptonſhire*, happen'd a formidable *Hurricane*, ſcarce bearing 60 yards in its breadth, and ſpending it ſelf in about 7 minutes of time. Its firſt decerned aſſault was upon a *Milk-maid*, taking her Pale and Hat from off her Head, and carrying her Pail many ſcores of yards from her, where it lay undiſcovered ſome days. Next it ſtorm'd the yard of one *Sprigg*, dwelling in *Weſthorp*, where it blew a Waggon-body off the *Axle-trees*, breaking the *Wheels* and *Axle-trees* in pieces, and blowing 2 of the *Wheels* ſo ſhatter'd over a Wall. This *Waggon* ſtood ſomewhat croſs to the paſſage of the *Wind*. Another *Waggon* of Mr. *Saliſbury's* marched with great Speed upon its *Wheels* againſt the ſide of his Houſe, to the Aſtoniſhment of the Inhabitants A branch of an *Aſh-tree*, of that Bigneſs that 2 luſty Men could ſcarce lift it, blew over Mr. *Saliſbury's* Houſe without hurting it, and yet this branch was torn from a Tree an hundred Yards diſtant from that Houſe. A Slate was forced upon a Window of the Houſe of *Sam. Templer* Eſq; which very much bent an Iron Bar in it; and yet 'tis certain, that the neareſt place, the Slate was firſt forced from, was

Hurricanes and Storms, *By* Mr. J. Templer, n. 71.p.2156.

near 200 Yards. At Mr. *Maidwell's* Senior, it forced open a Door, breaking the Latch, and thence marching thro' the *Entry*, and forcing open the Dairy-door, it overturned the Milk-Veſſels, and blew out three Panes or Lights in the Window, next it mounted the *Chambers*, and blew out 9 *Lights* more. From thence it proceeded to the *Parſonage*, whoſe Roof it more than decimated; thence croſſeth the narrow Street, and forcibly drives a Man headlong into the doors of *Tho. Briggs.* Then it paſſed with a curſory Salute at *Tho. Marſton's*, down to Mr. *Geo. Wignil's*, at leaſt a *Furlong's* Diſtance from *Marſton's*, and two Furlongs from *Sprig's*, where it plaid notorious Exploits, blowing a large Hovel of *Peaſe* from its Supporters, and ſetting it cleverly upon the Ground without any conſiderable damage to the Thatch. Here it blew a Gate-poſt fix'd 2 Foot and an half in the Ground, out of the Earth, and carried it into the Fields many yards from its firſt Abode.

About ½ a Mile diſtant from the Town, is a ſmall *Wood* on the top of an Hill, and partly deſcending into a Vale encompaſſed by Northerly and Southerly Hills; ſo that the Wind may ſeem confin'd to the Vale as a *Channel*, before it aſſaulted the Town, and thereby enforc'd to ſpend it ſelf only in that *Glade*. But I am unapt to think, that ſome *Flatus* from the deſcending Wood-ground might contribute to this Accident, becauſe the Wind continued, ſo far as Men could judge, as high in the Field afterwards; and the Scite of the Town did expoſe (by reaſon of thoſe Valleys) a far greater part of the Town to this Damage than was troubled, the Valley being above 4 or 5 times the Breadth of that part of the Town concerned in it.

By Mr. J. Templer, ib. p. 2157.

2. *Oct.* 13. 1670. At *Braybrook* in *Northamptonſhire*, about 11 a Clock, the Wind in a ſtrange form aſſaulted a Peale Reek in the Field, uncovering the Thatch of it, and leaving another within 20 yards unconcerned. Thence it proceeded to the Parſonage, where it carried not 12, ſcarce 8 yards in breadth, blowing up the end of a *Barley Reek*, and therewith ſome Stakes in it of near 5 Foot long. In the mean while, it left a *Wheat-hovel*, within 6 yarks of the *Barley-Reek* and being without all Shelter, untouched, no part of the Thatch of the *Hovel* being ſo much as furled. Nevertheleſs it beat down a *Jack-daw* from the Reek with that Violence as forced the Guts out of the Body, and made it bleed plentifully at the Mouth. This I ſaw, and took up in ſome Company the Daw very warm. Thence it went in a right Line to the Parſonage Houſe, took off the Cover of all the Houſe in its Compaſs. From hence it paſſed over the Town without any Damage, the reſt of the Town being low in Situation, and went on to a Place called *Forthill*, where it uncloathed ſo much of a Malt-houſe as lay within its Line and Breadth, ſo as to expoſe the Mault upon the Floor to the open Air.

Braybrook ſtands in a Valley environed by Hills on 3 ſides, at 3 Quarters of a Mile's diſtance from it. But (what I could chiefly obſerve) there is an Hill call'd by the Name of *Clackhill*, within a Mile of it, and exactly in that point of the *Compaſs* in which the Wind then ſtood; no Hill in its way till the *Wind* had paſſed over all the places it endamaged. And which is remarkable, there have been two Earthquakes in this Town within theſe 10

Years, when the then gentle Air (or Wind ſhall I call it) only vibrated upon that point of the Compaſs.

By Sir Geo. Makenzie n. 124. p 307. 3. *Dec.* 21. 1674. the *Wind* here (at *Tarbut*) was extraordinary: It broke a Standard-Stone, that ſtood as an *Obeliſk* near an old Church; which Stone was about 12 Foot high, 5 Foot broad, and near 2 Foot thick. Whole Woods were overturned, and torn up from the Root, though in a low Situation. It blew from the North-weſt, and of a long time the Wind had continued Weſterly.

By Mr. Scarſburgh, n. 231. p 659. 4. *Oct.* 19. 1693. There happen'd a moſt violent Storm in *Virginia*, which ſtopped the Courſe of the ancient Channels, and made ſome where never were any: So that betwixt the Bounds of *Virginia*, and *Newcaſtle* in *Penſilvania*, on the Sea-board-ſide, are many navigable Rivers for Sloops and ſmall Veſſels.

By . . . . n 212. p. 592. 5. *Aug.* 1. 1694. There happen'd here (at *Warrington* in *Northamptonſhire*) between 1 and 2 a Clock a very terrible *Whirlwind* amongſt the Shocks of Corn, in that part of *Acrement Cloſe*, which is in the poſſeſſion of Mr. *Holt*, and took up into the Air about 80 or 100 Shocks, carried a great deal out of Sight; the reſt was ſcattered about the Field, or on the Tops of Houſes or Trees thereabouts. I have ſeen of the Corn which was carried a Mile diſtant from the Field, and it is reported by Perſons of good Credit, that ſome was carried 4 or 5 Miles diſtant. The Whirlwind continued in *Acrement Cloſe* full half an Hour; I my ſelf, and ſeveral other Perſons, ſaw at leaſt 3 or 4 Waggon Loads of Corn all at once whirled about in the Air.

A Spout at Topſham, *near* Exeter, *by* Mr. Zach. Maine, n 215. p. 18. XXIX. Theſe appearances are frequent abroad, but very ſeldom or never ſeen before with us, tho' ſome pretend to have ſeen of them in the *Downs*. The *French* call them *Trombs*, I ſuppoſe from the Figure and the Noiſe that they make, that word ſignifying a ſort of a *Humming Top*. They are certain Elevations of Water during *Storms* and *Tempeſts*, reaching from the Superficies of the Sea to the Clouds. They happen ſeveral ways, ſometimes the Water is ſeen to boil, and raiſe it ſelf for a conſiderable ſpace round about a foot from the ſurface, above which appears, as it were, a thick and black ſmoke, in the midſt of which is obſerved a ſort of Stream or Pipe reſembling a Tunnel, which ariſeth as high as the Clouds; at other times theſe Pipes or Tunnels are obſerv'd to come from the Clouds, and ſuck up the water with great Noiſe and Violence. They move from the Place where they were firſt gathered according to the motion of the *Wind*, and diſcharge themſelves ſometimes into the Sea, to the unavoidable Deſtruction of ſuch Ships as are in their way, if they be ſmall Veſſels, and to their great damage be they never ſo big. Sometimes on the Shore, beating down all they meet with, and raiſing the Sand and Stones to a prodigious height. 'Tis ſaid that Veſſels, that have any force, uſually fire their Guns at them loaden with a Bar of Iron, and if they be ſo happy as to ſtrike them, the Water is preſently ſeen to run out of them with a mighty Noiſe, but no further Miſchief.

One of theſe *Spouts* happen'd here at *Topſham*, *Aug.* 7. 1694. between 9 and 10 of the Clock in the Forenoon; 'twas then very near, if not quite

Low-Water, which is look'd on as a ſpecial Providence, ſince had it been High-Water, 'tis concluded its Strength would have been much greater, and its conſequences more ſad. The Water that was neareſt ſeemed to fly hither and thither, as tho' it would fain make its Eſcape from it: Yet I cannot find upon enquiry that the Channel was at all wholly dry. There was alſo ſome Wind, tho' not ſo violent as it had been before; or when the *Spout* or *Tromb* began to move, it went with the wind (which was then at *W.N.W*) like a dark Smoke.

The Marks + + + ſhew the River, *O*, the *Spout*, *S*, Mr. *Seaward's* Houſe, which it gently toucht with little Damage, blowing only off a few Tiles; *G*, Widow *Goldsworthy*'s Houſe, which it in part uncovered, and took almoſt all the Thatch off her Garden Wall. It took off alſo an Apple-tree, which was no way decayed, and between 15 and 16 Inches about, within 2 or 3 Inches from the Ground, almoſt as exactly as any Saw could have done it, and carried it, as I judge, between 20 and 30 Foot from the place where it grew, and that not forward in the Path that it took, but almoſt directly backward which makes me conclude that it had a double Motion; the one external from the Wind ſtrait forward, the other internal and circular, like the *Fly* of a *Jack* which a Man may carry in his Hand, that will ſtrike any thing either forward or backward as it meets with it. *H*, Mr. *Green*'s Houſe, which was for the moſt part until'd. There were 2 Houſes more, *W*, *L*, very much damaged in their Coverings, yet Mr. *Moxam*'s *M*. tho' it ſtood between them, and was much higher than either, had only 2 or three Quarries of Glaſs broken. *EEEEE*, ſhews the March of the Spout. *X*, Planks that were blown ſome upright, ſome ſeveral Yards out of their place, *D*, a Ship newly lanched, of about one Hundred Tuns, which was much ſhaken, but not hurt. *K*. a Maſt of near a Tun weight, thrown out of its Place. *C*, an Anchor that was torn out of the Ground, and carried 7 or 8 foot with a Boat that was faſten'd to it and blown up into the air; that Boat was rent from the *Head* to the *Keel*. *B*, another new Boat blown about 6 Foot high, and turned upſide down. *F*, a Fiſher-boat with one Man in it, which was near the Place where the *Spout* was at firſt perceived, but thro' Mercy eſcaped. *P*, a Lane that goes from the River in which ſome Houſes ſuffered Damage, which ſhews that the *Spout* was divided in its March. 'Tis no ſmall Mercy that no Man, Woman, or Child received the leaſt Injury in their Perſons.

Fig. 19.

Prognoſticks of the Wind, By J. Gill, n. 26. p. 481.

XXX. 1. *John Gill* affirms, that he hath obſerved on ſeveral Occaſions that being in a Calm, that way which the Sea began to loom or move, the next Day the Wind was ſure to blow.

Prognoſticks of Hurricanes by Capt. Langford, n. 246. p. 407.

2. It hath been the Cuſtom of our *Engliſh* and *French* Inhabitants of the *Caribbee Iſlands* to ſend in, about the Month of *June*, to the Native *Caribbees* of *Dominico* and St. *Vincent*, to know whether there would be any *Hurricanes* that Year; and about 10 or 12 Days before the *Hurricane* came they did conſtantly ſend them Word, and it very rarely or ſeldom failed. From one of theſe *Indians*, (whom in 1657 I engaged by Civilities to remain with me ſeveral Years,) I had the following Prognoſticks.

1. All Hurricanes come either on the Day of the Full, Change, or Quarters of the Moon.

2. If he will come on the Full-Moon, you being in the Change, then obſerve theſe Signs.

That Day you will ſee the Skies very turbulent, the Sun more red than at other times, a great Calm, and the Hills clear of Clouds or Fogs over them, which in the *Highlands* are ſeldom ſo. Likewiſe in Hollows, or Concaves of the Earth, or Wells, there will be a great Noiſe, as if you were in a great Storm, and at Night the Stars looking very big with Burs about them, and the North-weſt Sky very black and foul, the Sea ſmelling ſtronger than at other times, as uſually it doth in great Storms, and ſometimes that Day, for an Hour or two, the Wind blows very hard weſterly, out of his uſual Courſe.

On the Full of the Moon you have the ſame Signs, but a great Bur about the Moon, and many times about the Sun.

The like Signs muſt be taken notice of on the Quarter Days of the Moon, in the Months of *July*, *Auguſt*, and *September*; for the Hurricanes come in thoſe Months; the ſooneſt that I ever heard of was the 25*th* of *July*, and the lateſt was the 8*th* of *September*, but the uſual Month they come in is *Auguſt*.

The Benefit I have had of foretelling theſe Hurricanes is, that whereas heretofore they were ſo dreadful, that all Ships were afraid to go to Sea, and did rather chuſe to ſtay in the Roads at Anchor, than to run the hazard of the mercileſs Sea, altho never Ship eſcaped at Anchor, but was caſt aſhore, many times by the violence of the Storm, ſome Veſſels have been caſt ſo far on the Shore, that when the Storm was over, they have been from 20 or 30 Yards dry from the Waſh of the Shore, and the Veſſels ſet whole; and by this means the Lives of thoſe that were in thoſe Veſſels were ſaved. But I finding that if a Man keeps his Ship ſailable, with good Store of Ballaſt, his Ports well barr'd and calkeds, his Top-Maſts down, and his Tops too if he have time, his Yards a-port laced, or long Ships, keeping ſecure his Doors and Windows of his Ship, and ſhe will lie as well as in other Storms, and they may, having their Ships in a Readineſs, ſtay in the Road till the Storm begins, which is always firſt at North, ſo to the North-weſt, till he comes round to the South-eaſt, and then his Fury is over. So with the North Wind they may run away to the South, to get themſelves Sea-room for drift of the South-weſt Wind where he blows very fiercely; by theſe means I have, by God's Bleſſing, preſerved my ſelf in two Hurricanes at Sea, and in three at Shore, in the Years 1657, 1658, 1660, 1665 and 1667. thoſe at Sea, I loſt not a Sail, Yard, or Maſt; they being two great Hurricanes. And in the Year 1667, I being on Shore at *Nevis*, there was a Hurricane on the 19*th* Day of *Auguſt*, and fourteen Days before I did take Notice of the foregoing Signs on a full Moon, and I acquainted Sir *John Berry* who was Commander of his Majeſty's Ship *Coronation*, and ſeveral other Commanders there, who did make their Ships ready for the Sea; and in the Morning about 4 of the Clock, the Wind coming hard Northerly, they put to Sea ; and by God's Bleſſing came all back in 4 or 5 Days time, ſafe to the Road again. On the Shore, being confident of the Hurricane's coming, I took ſuch Care before-hand to ſecure my Sugars and Goods in the Store houſe, that when the Hurricane had carried away the Roof of the Houſe, all except one Hogſhead of Sugar remained ſafe.

The Reaſons and Cauſes of theſe violent Storms, according to my Judgment, may be theſe.

1. It is not unknown to all Men of Experience, that to the ſouthward of the *Tropick*, there is conſtantly a *Trade-wind*, or Eaſterly Wind, which goes from the North to the South-Eaſt all the Year about ; except where there are Reverſions of *Breezes*, and Inlets near the Land ; ſo that when this Hurricane, or rather Whirl-wind comes in Oppoſition to the conſtant Trade-wind, then he pours down with that Force and Violence, that it exceeds all Storms of Wind in the World ; for he takes Trees away by the Roots, and thoſe that are extraordinarily ſtrong rooted, he twiſts off in the middle: In the Hurricane in 1667, at *Nevis*, I ſaw the high Mountain that was all green with Trees, left in moſt Places bare, and the Wood lying in ſuch a Condition, with half Trees, or Stumps, or Quarters, that one would think it almoſt incredible.

2. It is remarkable by all Men that have been in thoſe parts where the Sun comes to a *Zenith*, that at his approach towards the *Zenith* there is always fair Weather ; but at his Return to the Southwards, it occaſions off the North Parts of the *Equinoctial* generally much Rains and Storms, as *Tornado's* and the like, which makes the Wind in the *Tornado's* to come on ſeveral Points. But before it comes, it calms the conſtant Eaſterly Winds; and when they are paſt, the Eaſterly Wind gathers Force again, and then the Weather clears up fair.

3. The Wind being generally betwixt the *Tropicks* eaſterly, unleſs at ſuch times as before declared, meeting with the Oppoſition of theſe *Hurricanes*, which comes in a contrary courſe to that *Trade-Wind*, doth cauſe this violent *Whirl-wind*, on the Sun's leaving the *Zenith* of *Barbadoes*, and thoſe adjacent Iſlands ; by which the Eaſterly Wind doth much decay of his Strength ; and then the weſt Wind, which is kept back by the power of the Sun, doth with the greater Violence and Force pour down on theſe parts where he encroaches. And it is uſual in our ſailing from *Barbadoes*, or thoſe Iſlands, to the North for a Weſterly Wind when we begin to loſe our Eaſterly Wind to have it calm, as it is before *Hurricanes* : And then the Wind ſpringing up, cauſeth it, till it comes well ſettled, to be various, but after the ſettled Weſterly Wind comes freſh, we have been conſtantly without thoſe Shufflings from Point to Point.

Here is to be obſerved, that all *Hurricanes* begin from the North to the Weſtward, and on thoſe points that the Eaſterly Wind doth moſt violently blow, doth the *Hurricane* blow moſt fiercely againſt it ; For from the *N.N.E.* to the *E.S.E.* the Eaſterly Wind bloweth freſheſt ; ſo doth the *W.N.W.* to the *S. S.W.* in the *Hurricane* blow moſt violent ; and when

he

he comes back to the *S. E.* which is the common Courſe of the *Trade Wind*, then he ceaſeth of his violence, and ſo breaks up. So, with Submiſſion to better Judgments, I take the cauſe of *Hurricanes* to be the Sun's leaving the *Zenith* of thoſe parts towards the South. And Secondly, the Reverſe or Rebounding back of the Wind, which is occaſioned by the Calming of the *Trade Wind*.

But it will be objected, Why ſhould not this Storm be all over thoſe parts of the *Weſt-Indies*, as well as *Barbadoes* and the *Leeward-Iſlands*? To which I anſwer, That it hath, in about 25 Years of my Experience, taken its courſe from *Bermudoes*, or *Summer-Iſlands*, to the *Caribbee Iſlands*; but ſeldom or never doth he carry ſuch a Breadth, as from the Latitude of 16 to 32 Degrees, which is the Latitudes of the one and the other places; but it hath been obſerved, that when *Hurricanes* have been in *Martinico*, which is within two Degrees of Latitude, and two Degrees of Longitude, according to the Miles of that Circle, yet no *Hurricane* hath been in *Barbadoes*; nor could I ever call any of the former Storms at *Barbadoes Hurricanes*, till that in 1675. Again, it hath been noted, that *Hurricanes* have done the like to the Northwards: For when the *Hurricane* hath been in *Antegoa* and St. *Chriſtopher*'s, thoſe Ships that were but in the Latitude of 20 Degrees had no *Hurricane*, but conſtant Weſterly Winds reaſonable Fair, and then there were no *Hurricanes* in *Bermudoes*; and when the *Hurricanes* were at *Bermudoes*, the *Leeward* or *Caribbee Iſlands* had no *Hurricane*; nor had thoſe Iſlands the *Hurricane* when *Barbadoes* had it.

It well be further Objected, Why the *Hurricane* was never known to go farther to the Weſtward than *Porto Rico*, which lies in or near the Latitude of thoſe Iſlands of St. *Chriſtopher*'s? To this I Anſwer, That from *Porto Rico* downwards, both that Iſland as well as *Hiſpaniola*, and other Iſlands there adjacent are of vaſt greatneſs and very high Lands, that of themſelves doth moſt commonly give Reverſal or Weſterly Winds at Night, through the Year: For there, for the Reaſons aforeſaid, the Eaſterly Wind, towards Night doth Calm, and thoſe Lands afford a *Land Wind*, which the other Iſlands cannot do, by Reaſon of the ſmallneſs of thoſe *Caribbee Iſlands*, but very near the Shore, the *Trade Wind* having his full Power till this General *Whirl-Wind* comes, for the Reaſons aforeſaid.

I do imagine ſo likewiſe to the Southwards of *Barbadoes*, where the *Tornadoes* come frequently, there is no *Hurricanes*; neither was there at *Barbadoes*, when theſe *Tornadoes* did commonly come there, which made ſome ſmall Reverſal, though it was but for 2 or 3 Hours: Yet the Eaſterly Wind, giving ſome way by the Sun's Declining from that *Zenith*, doth prevent this Furious Reverſe, where it hath no Vent, till by the Violence of the two *Winds* it is forced.

An Experiment of the Evaporation of Water; By Mr. Edm. Halley. 139. p. 366.

XXXI. We took a Pan of *Water* (ſalted to the ſame degree as is common *Sea-Water*, by the Solution of about a *40th* part of Salt) about 4 Inches deep, and 7 Inches $\frac{9}{10}$ Diameter, in which we placed a *Thermometer*, and by means of a Pan of Coals, we brought the *Water* to the ſame degree of heat, which is obſerved to be that of the Air in our hotteſt Summers; the *Thermometer* nicely ſhewing it. This done, we affixed the Pan of *Water*, with the *Thermometer* in it, to one end of the beam of the Scales, and exactly counterpoiſed it with Weights in the other Scale; and by the application or removal of the Pan of Coals, we found it very eaſy to maintain the *Water* in the ſame degree of heat preciſely. Doing thus, we found the Weight of the *Water* ſenſibly to Decreaſe; and at the end of two Hours, we obſerved that there wanted half an Ounce *Troy*, all but 7 Grains, or 233 Grains of *Water*, which in that time had gone off in Vapour; tho' one could hardly perceive it ſmoak, and the *Water* were not ſenſibly Warm. This quantity in ſo ſhort a time ſeemed very conſiderable, being little leſs than 6 Ounces in 24 Hours, from ſo ſmall a Surface as a Circle of 8 Inches Diameter. To reduce this Experiment to an exact *Calculus*, and determine the thickneſs of the Skin of *Water* that had ſo Evaporated, I aſſume the Experiment alledged by Dr. *Edw. Bernard* to have been made in the *Oxford Society*, *viz.* that the Cube Foot *Engliſh* of *Water* weighs exactly 76 Pounds *Troy*; this divided by 1728, the Number of Inches in a Foot, will give $253\frac{1}{3}$ Grains, or half Ounce $13\frac{1}{3}$ Grains for the Weight of a Cube Inch of *Water*; wherefore the Weight of 233 Grains is $\frac{233}{253}$ or 35 parts of 38 of a Cube Inch of *Water*. Now the Area of the Circle, whoſe Diameter is $7\frac{9}{10}$ Inches, is 49 Square Inches; by which dividing the quantity of *Water* Evaporated, *viz.* $\frac{35}{38}$ of an Inch, the Quote, $\frac{35}{1862}$, or $\frac{1}{53}$, ſhews that the Thickneſs of the *Water* Evaporated was the 53*d* part of an Inch: But we will ſuppoſe it only the 60*th* part, for the facility of Calculation. If therefore *Water* as Warm as the Air in Summer, Exhales the thickneſs of a 60th part of an Inch in two hours from its whole Surface, in 12 hours it will exhale $\frac{1}{10}$ of an Inch; which quantity will be found abundantly ſufficient to ſerve for all the Rains, Springs, and Dews, and account for the *Caſpian Sea*'s being always at a Stand, neither waſting nor overflowing; as likewiſe for the Current ſaid to ſet always in, at the *Streights* of *Gibraltar*, tho' thoſe *Mediterranean Seas* receive ſo many and ſo conſiderable Rivers.

To eſtimate the Quantity of *Water*, ariſing in Vapour out of the Sea, I think I ought to conſider it only for the time the Sun is up, for that the Dews return in the Night as much if not more Vapours than are then Emitted; and in Summer the Days being longer than 12 Hours, this exceſs is balanced by the weaker Action of the Sun, eſpecially when Riſing before the *Water* be warmed: So that if I allow $\frac{1}{10}$ of an Inch of the Surface of the Sea to be Raiſed *per diem* in Vapours, it may not be an improbable Conjecture.

Upon this Suppoſition, every 10 Square Inches of the Surface of the *Water* yields in Vapour *per diem* a Cube Inch of *Water*; and each Square Foot half a *Wine* Pint; every ſpace of 4 Foot Square, a Gallon; a Mile Square, 6914 Tons; a Square Degree, ſuppoſe of 69 *Engliſh* Miles, will Evaporate 33 Millions of Tuns: And if the *Mediterranean* be eſtimated at 40 Degrees long and 4 broad, allowances being made for the Places where it is broader by thoſe where it is narrower, (and I am ſure I gueſs at the leaſt) there will be 160 Square Degrees of Sea; and conſequently the whole *Medi-*

terranean muſt loſe in Vapour, in a Summer's Day, at leaſt 5280 Millions of Tuns. And this quantity of Vapour, though very great, is as little as can be concluded from the Experiment produced: And yet there remains another Cauſe, which cannot be reduced to the Rule, I mean the *Winds*, whereby the Surface of the *Water* is lick'd up, ſomewhat faſter than it Exhales by the Heat of the Sun, as is well known to thoſe that have conſidered thoſe Drying *Winds* which Blow, ſometimes.

The *Mediterranean* receives theſe conſiderable Rivers; the *Iberus*, the *Rhone*, the *Tiber*, the *Po*, the *Danube*, the *Neiſter*, the *Boryſthenes*, the *Tanais* and the *Nile*, all the reſt being of no great Note, and their quantity of *Water* inconſiderable. We will ſuppoſe each of theſe nine Rivers to bring down Ten times as much Water as the River *Thames*, not that any of them is ſo great in reality, but to comprehend with them all the ſmall Rivulets that fall into the Sea, which otherwiſe I know not how to allow for.

To Calculate the Water of the *Thames*, I aſſume that at *Kingſton Bridge*, where the Flood never reaches, and the Water always runs down, the Breadth of the Channel is 100 Yards, and its Depth 3, it being reduced to an equality, (in both which Suppoſitions I am ſure I take with the moſt.) Hence the Profile of the Water in this place is 300 Square Yards: This Multiplied by 48 Miles, (which I allow the Water to run in 24 Hours, at 2 Miles in an Hour) or 84480 Yards, gives 25344000 Cubick Yards of Water to be Evacuated every Day, that is, 20300000 Tons *per diem*; and I doubt not but in the exceſs of my meaſures of the Channel of the River, I have made more than ſufficent allowance for the Waters of the *Brent*, the *Wandel*, the *Lea*, and *Darwent*, which are all worth notice, that fall into the *Thames* below *Kingſton*.

Now if each of the aforeſaid 9 Rivers yield Ten times as much Water as the *Thames* doth, 'twill follow that each of them yields but 203 Millions of Tons *per diem*, and the whole 9 but 1827 Millions of Tons in a Day; which is but little more than $\frac{1}{3}$ of what is proved to be raiſed in vapour out of the *Mediterranean* in 12 Hours time.

The Evaporation of Water in a Cloſe Room at Greſham Coll. 1693. *By* Mr. Edm. Halley, n. 212. p. 183.

XXXII. In Order to explain the Circulation of Vapour Experimentally, I cauſed an Experiment of the Quantity of Vapours ariſing ſimply from the Warmth of the Water, without being expoſed either to Sun or Wind, to be made in *Greſham College*, which was performed with great Care and Accuracy by Mr. *Hunt*, *Operator* to the *Royal Society*. Having added up into one Sum the Evaporations of the whole Year, I find, that from a Surface as near as could be meaſured, of 8 Square Inches, there did Evaporate during the Year, 16292 Grains of Water, which is 64 Cube Inches of Water, and that divided by 8 Inches, the Area of the Water's Surface, ſhews that the depth of Water Evaporated in one Year amounts to 8 Inches. But this is much too little to anſwer to the Experiments of the *French*, who found that it rained 19 Inches Water in a Year at *Paris*; or thoſe of Mr. *Townley*, who by a long continued Series of Obſervations, has ſufficiently proved, that in *Lancaſhire*, at the Foot of the Hills, there falls above 40 Inches of Water in the Year's time. Whence it is very obvious, that the Sun and Wind are much more the Cauſes of Evaporation, than any internal Heat or Agitation of the Water.

The ſame Obſervations do likewiſe ſhew an odd quality in the vapours of Water, which is that of adhering to the Surface that exhaled them, which they clothe as it were with a *Fleece* of vaporous Air, which once inveſting it, the Vapour riſes afterwards in much leſs quantity: which was ſhewed by the ſmall Quantity of water that was loſt in 24 hours time, when the Air was very ſtill from Wind, in proportion to what went away when there blew a ſtrong Gale, altho' the Experiment were made in a Place as cloſe from the Wind as could well be contrived. For which Reaſon I do not at all doubt, that had the Experiment been made where the Wind had come freely, it would have carried away at leaſt three times as much as we found, without the Aſſiſtance of the Sun, which might perhaps have doubled it.

By the ſame Experiment it likewiſe appears, that the Evaporations in *May*, *June*, *July* and *Auguſt*, (which are nearly equal) are about three times as much as what evaporated in the four Months of *November*, *December*, *January*, and *February*, which are likewiſe nearly equal, *March* and *April* anſwering nearly to *September* and *October*.

This *Fleece* of Vapour in ſtill Weather hanging on the ſurface of the Water, is the Occaſion of very ſtrange Appearances, by the Refraction of the ſaid Vapours differing from that of the common Air, whereby every thing appears raiſed; as Houſes like Steeples, Ships as on Land above the Water, and the Land raiſed, and as it were, lifted from the Sea, and many times ſeeming to overhang. And this may give a tolerable account of what I have heard of ſeeing the Cattle, at high Water time, in the Iſle of *Dogs* from *Greenwich*, when none are to be ſeen at low Water, (which ſome have endeavour'd to explain, by ſuppoſing the Iſle of *Dogs* to have been lifted by the Tide coming under it. But the evaporous Effluvia of Water, having a greater Degree of Refraction than the common Air, may ſuffice to bring thoſe Beams down to the Eye, which when the Water is retired, and the Vapours ſubſided with it, paſs above, and conſequently the Objects ſeen at the one time, may be conceived to diſappear at the other.

JANUARY 1693.					FEBRUARY 1693.				
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*
1	31½	5	29. 7	Froſt.	1	36	29	30. 0	
2	21	14	29. 7	Some Rain.	2	27	26	30. 2	
3	21	18	29. 7		3	33	25	30. 2	
4	23½	8	29. 7		4	48	16	29. 9	
5	23½	8	30, 1		5	39½	20	29. 9	Some Rain.
6	26½	1	30. 5	Froſt.	6	26	16	29. 9	Small Rain.
7	31	—3	30. 5	Froſt.	7	26	17	29. 8	
8	25	—5	30. 4	Froſt.	8	28	11	29. 9	A Fogg.
9	23	—3	30. 4	Froſt.	9	23	16	30. 0	
10	18	0	30. 4		10	26	20	30. 0	
11	18	0	30. 4		11	39	8	30. 0	
12	18	—0	30. 4		12	40	5	29. 8	
13	22	—6	30. 3	Froſt.	13	52	—1	29. 4	High Wind.
14	20½	—7	30. 3	Froſt.	14	35	6	29. 2	
15	21½	—10	30. 3	Froſt.	15	35	11	29. 4	Some Rain.
16	24	—15	30. 4	Froſt.	16	24	20	29. 2	Rain.
17	18	—13	30. 3½	Froſt.	17	39	20	29. 5	Rain.
18	18	—11	30. 2	Froſt.	18	39	19	29. 8	
19	14	—10	30. 1	Froſt.	19	35½	17	29. 7	
20	14	—3	29, 6		20	35½	16	29. 3	
21	21	0	29. 9		21	35	17	29. 0	Rain.
22	18	2	39. 9		22	29	10	29. 2	
23	18½	0	30. 0	Froſt.	23	35	5	29. 3	
24	18½	—3	30. 0	Froſt.	24	37	1	29. 2	
2	14½	9	29. 9		25	35	—5	29. 4	
26	14½	14	29. 7		26	23½	—8	29. 0	Snow.
27	20	17	29. 2		27	21	—11	29. 4	Froſt.
28	36	10	29 7		28	24	—14	29. 3	Froſt.
29	27½	15	29. 5	Some Rain.					
30	27½	15	29. 7						
31	27	27	29. 6						
	675 *Grains.*					690½ *Grains.*			

MARCH. 1693.

D.	Grains.	Ther.	Barometer.	Weather
1	25	—12	29. 2	Froſt
2	31½	—12	29. 1	Snow
3	28	—13	29. 3	Snow Froſt
4	28	—12	29. 6	Froſt
5	28	—8	29. 3	Froſt
6	20	— 1	29. 1	
7	35½	5	29. 3	Rain
8	39	9	29. 7	
9	42½	8	30. 0	
10	39	14	30. 0.	
11	33	21	30. 0	
12	42	21	29. 8	
13	42	22	29. 6½	
14	46	23	29. 4	
15	62½	14	29. 6	
16	41	19	29. 5	
17	42½	12	29. 4	
18	50	10	28. 9	
19	51½	7	29. 2	
20	45	8	29. 2	
21	41	7	29. 0	
22	50	8	29. 4	
23	37	10	29. 5	
24	33½	6	29. 4	
25	27½	7	29. 3	
26	30	11	29. 4	
27	57	9	29. 6	
28	38	4	29. 6	
29	30	17	29. 5	
30	30	20	29. 4½	
31	20	24	29. 3	
	1166 *Grains.*			

APRIL. 1693.

D.	Grains.	Ter.	Barometer.	Weather
1	32	15	29. 4	
2	39	15	29. 5	
3	37½	14	29. 7	
4	37	23	29. 6½	
5	38	29	29. 2	
6	29	32	29. 2	
7	32	33	29. 3	
8	32	35	29. 4	
9	28½	40	29. 2	
10	35	33	29. 4	
11	37	33	29. 4	
12	34	37	28. 9	
13	39	32	29. 4	
14	39	33	29. 5	
15	39	29	29. 7	
16	35	30	29. 8	
17	37	31	29. 6½	
18	36½	36	29. 4	
19	38½	36	29. 3½	
20	36	32	29. 3	
21	39	37	29. 2	
22	46	35	29 4	
23	42½	35	29. 5	
24	52	35	29. 2	
25	50	35	29. 3½	
26	56	36	29. 7	
27	38	44	29. 5	
28	43	46	29. 7½	
29	40	49	29. 6	
30	52	42	29. 9	
	1203 *Grains.*			

MAY. 1693.					JUNE. 1693.				
D.	Grains.	Ther.	Barometer.	Weather	D.	Grains.	Ther.	Barometer.	Weather
1	56	36	30. 1		1	78	65	29. 9	
2	61	26	30. 0		2	85	62	30. 0	
3	66	21	30. 1		3	95	54	30. 2	
4	61	19	30. 1		4	77	52	30. 1½	
5	52	31	30. 1		5	63	50	29. 9	
6	48	45	29. 8		6	49	60	29. 7½	
7	59½	35	29. 8		7	46	67	29. 7	
8	51	34	29. 7		8	63	63	29. 7	
9	51	31	29. 6		9	63	69	29. 8	
10	43	35	29. 5		10	63	63	29. 8	
11	49	30	29. 5		11	55	70	29. 8½	
12	54	32	29. 6		12	58	87	28. 8	
13	59	26	29. 7		13	59	75	29. 9	
14	59	32	29. 7½		14	86	72	29. 7	
15	46½	35	29. 7		15	63	79	29. 8	
16	46½	34	29. 8½		16	58	78	29. 9	
17	56	36	30. 1		17	86	79	30. 0	
18	70½	35	30. 3		18	81	66	30. 0	
19	58½	47	30. 1		19	92	57	30. 1	
20	76	50	30. 0		20	81	60	30. 0	
21	52	52	30. 1		21	80	71	29. 9	
22	73	64	30. 1		22	76	67	29. 8	
23	78½	64	30. 1		23	63	69	29. 7	
24	90	62	29. 9½		24	63	62	29. 6	
25	61	74	29. 9		25	57	65	29. 8	
26	67½	68	29. 9½		26	46	70	30. 0	
27	64	75	29. 9½		27	49½	66	30. 0	
28	71	67	30. 1		28	52	74	30. 0	
29	80	69	30. 2		29	59	68	30. 2	
30	89½	70	30. 2		30	62	69	30. 2	
31	106	68	29. 9						
	1968 *Grains.*					2008½ *Grains.*			

JULY. 1693.					AUGUST. 1693.				
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	*D.*	*Grains.*	*Ther.*	*Barometer.*	*Weather.*
1	75	67	30. 0		1	80	71	29. 5	
2	75	67	30. 0		2	77	73	29. 6	
3	63	62	30. 0		3	77	63	29. 8	
4	62	61	30. 1		4	78	64	29. 9	
5	60	63	30. 1		5	79	73	29. 9	
6	74	65	30. 0		6	81	70	29. 9	
7	61	65	30. 0		7	94	83	29. 6	
8	51	65	30. 0		8	79	86	29. 6	
9	46	74	29. 9		9	68	82	29. 7	
10	52	77	29. 9		10	70	83	29. 8	
11	72	74	29. 8		11	92	85	29. 8½	
12	74	82	29. 4		12	70	80	30. 0	
13	88	75	29. 7		13	81	73	29. 9	
14	83	62	29. 9		14	68	75	29. 7	
15	84	65	30. 1		15	69	74	29. 9	
16	84	68	29. 8		16	77	72	29. 8	
17	71	58	30. 1		17	77	77	29. 7	
18	77	65	30. 2		18	84	77	29. 7	
19	66	78	30. 1½		19	86	64	29. 5	
20	71	78	30. 1		20	78	68	30. 0	
21	72	82	30. 0		21	68	67	29. 7	
22	90	74	30. 0		22	71	65	29. 7	
23	99	68	30. 0		23	75	55	29. 9	
24	85	71	30. 0		24	64	54	29. 5	
25	85	81	29. 9		25	63	57	29. 5	
26	94	75	29. 9½		26	58	59	29. 4	
27	97	70	29. 8		27	60	55	29. 5	
28	81	71	29. 7		28	53	55	29. 9	
29	87	67	29. 9		29	53	58	29. 7	
30	78	64	29. 9		30	53	56	29. 7	
31	78	79	29. 3½		31	63	48	29. 7	
	2335 *Grains.*					2246 *Grains.*			

SEPTEMBER. 1693.					OCTOBER. 1693.				
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	D.	*Grains.*	*Ther.*	*Barometer.*	*Wember.*
1	53	53	29. 7		1	40	35	29. 9	
2	55	50	29. 6		2	37	41	29. 6	
3	61	50	29. 7		3	41	35	29. 7	
4	61	48	29. 7		4	27	47	29. 6	
5	63	44	29. 8		5	29	48	30. 0	
6	74	40	29. 7		6	31	49	30. 2	
7	62	39	29. 6		7	29	58	30. 0	
8	39	45	29 5		8	37	60	30. 0	
9	40	52	29. 5		9	39	59	30. 2	
10	50	48	29. 6 ½		10	37	55	30. 1	
11	46	41	29. 7		11	34	55	29. 9	
12	48	43	29. 8		12	38	55	29. 8	
13	46	53	29. 7		13	39	42	30. 0	
14	43	57	29. 5		14	49	38	29. 8	
15	46	70	29. 2		15	44	28	29. 7	
16	49	54	29. 3		16	44	19	29. 7	
17	46	52	29. 1		17	35	23	29. 1	
18	52	45	29. 0		18	34	24	29. 2	
19	48	45	29. 3		19	34	20	29. 2	
20	50	44	29. 6		20	35	21	29. 5	
21	43	42	29. 9		21	35	17	29. 9	
22	41	51	29. 5		22	24	28	29. 7	
23	46	45	29. 9		23	28	25	29. 7	
24	44	52	29. 7		24	39	20	30. 0	
25	41	47	29. 8		25	41	13	30. 0	
26	43	47	29. 6		26	34	16	29. 9	
27	46	45	29. 7		27	33	13	30. 0	
28	47	40	29. 9		28	32	18	29. 8	
29	50	44	29. 8		29	33	10	29. 8	
30	40	42	29. 5		30	35	5	29. 7	
					31	28	7	29. 4	
	1495 *Grains.*					1095 *Grains.*			

NOVEMBER. 1693.					DECEMBER. 1693.				
D.	*Grains.*	*Ther.*	*Barometer.*	*Weather.*	*D.*	*Grains*	*Ther.*	*Barometer.*	*Weather.*
1	18	22	29. 6		1	34½	— 16	30. 0	Froſt
2	15	30	29. 7		2	16¼	— 10	30. 0	Rain
3	24	34	29. 6		3	12	— 0	29. 9	
4	26	30	29. 7		4	12	7	29. 4	Some Rain
5	33	21	29. 8		5	17½	10	22. 2	
6	33	10	29. 8		6	33	15	29. 4	Some Rain
7	29	9	29. 7		7	19½	15	29. 1½	
8	20	23	29. 5		8	18	20	29. 0	Rain & much W.
9	21	21	29. 9		9	18	27	28. 6½	R. and Storm
10	21	30	29. 7		10	25	16	28. 9	Some Rain
11	32	27	29 7		11	28¾	13	29. 6	
12	22½	34	29. 5		12	28	9	29. 5	
13	31	23	29. 4		13	25	14	29. 2	
14	25½	15	28. 9		14	15	20	29. 2	Some Rain
15	27	10	29. 4		15	19	20	29. 5	
16	25½	3	29. 6		16	22½	15	29. 5	
17	26	— 7	29. 5		17	17½	20	29. 5	
18	21	— 1	29. 5	great Fog	18	21½	10	30. 1	
29	21	— 2	29 5	great Fog	19	22	3	30. 0	
20	19	2	29. 6		20	16	6	29. 8	
21	15	5	29. 8	Fog	21	14½	9	29. 6	
22	11½	12	29. 7	ſome Rain	22	16½	14	29. 3	
23	20½	14	29. 7		23	22	11	28. 5	Stormy.
24	24½	8	29. 8		24	23	4	29. 0	
25	24½	5	29. 9		25	22	0	29. 5	Froſt.
26	33	— 12	29: 9	Froſt	26	22	5	29. 2	Rain
27	33½	— 12½	29. 9	Froſt	27	16	10	29. 3	
28	27	— 14	29. 8	Froſt	28	20	6	29. 0	
29	42	— 16	29. 8	Water	29	25½	0	29. 2	Froſt
30	42	— 17	29. 9	Frozen	30	29½	5	28. 6	Stormy
					31	24	7	29. 2	
	764. *Grains.*					646 *Grains.*			

Note, That in the Column of the *Thermometer*, —denotes degrees of Cold below the freezing Point; and that from the 10th of *Nov.* to the end, belong to the foregoing Year 1692.

The Changes of Weather from the Alterations of the Gravity of the Atmoſphere, By Dr. Gorden, n.271.p.991

XXXIII. 1. The *Air* agrees with all other *Fluids* in this, that it *gravitates*, and it has this peculiar Property (which is not ſo much obſerved of other *Fluids*) that its ſpecifical *Gravity* is not always the ſame. Now you know according to the certain Rules of the *balancing* of *Fluids* amongſt themſelves, every *Fluid ſpecifically lighter* than another, will aſcend and emerge above it, and every *Fluid ſpecifically heavier* than another, will *deſcend* and *ſubſide* below. Now there is ſome certain *Proportion* between the *ſpecifical Gravities* of the *Fluid* of *Air*, and of that which aſcends in *Vapours* and falls down again into *Rain*, and if this *proportion* were ſtill the ſame, 'tis like we would have no *commixture* of thoſe *Fluids*, but the *vapours* would either always *float* above or always ſtay below. But this *proportion* of their *ſpecifical Gravity* is frequently changed, for it's known that *Water* when warm and tepid is lighter than when it is cold, and the daily *Obſervations* of the different Heights of the *Mercury* in the *Baroſcope* do make appear, that the *Atmoſphere*'s Gravity is not always the ſame. And now from theſe known properties may be eaſily deduced a ſtatical account of the riſing of *Vapours*, their being carried in the Air in Clouds, and their falling down again into Rain. For if we may be allowed to ſuppoſe that when the *Atmoſphere* is heavieſt, there is ſome ſuch Proportion between its *ſpecifical Gravity*, and that of the Fluid of Vapours, as there is between *Water* and *Oyl*, the Vapours according to the known Laws of *Fluids* muſt needs aſcend, and ſo long as this *proportion* continues they muſt needs float above in the *Air*: but when the *Atmoſphere's Gravity* is chang'd, the *Vapours* muſt fall down again.

I do not know any determinate Inſtrument that will indicate the *Aſcent* of Vapours, as certainly as the *Baroſcope* does the Change of the *Air*'s Weight (for our common *Hygroſcopes* are not very exact, and beſides I ſuppoſe their *Change* by Moiſture ſhews rather the falling than the riſing of Vapours) yet there are 2 or 3 Obſervations which ſeem certain *Indications* of their Aſcent: as firſt, if the *Horizon* and the remote Hills ſeem ſmoaky, and inconſpicuous, ſo that nothing can be ſeen at any diſtance, and that tho' the Heavens be not cloudy but clear, and tho' there be no Fog nor yet any Cap of Clouds upon the hills (which do rather indicate the falling of *vapours*.) *Again*, if when you look to any diſtant part of the Country; round about you, it appear all in an undulating Motion, this ſeems to be a Sign of the plentiful riſing of Vapours, for this is only occaſioned by looking thro' an unequal Waving *Medium*, which makes frequent Inflections of the Beams of Light, as you ſee any Object ſeems to have a tremulating Motion in all its parts when you look upon it thro' Smoke. Another Indication of the Aſcent of Vapours ſeems to be the copious riſing of Steams above Waters, Mariſh Grounds, and Fens, which is frequently ſeen in Froſts, and in cool Nights in ſummer. To theſe I may add the redneſs of the Sun (ſo as to be eaſily look'd upon) and Moon, a conſiderable time before their ſetting, or after their riſing. Now ſince I have had occaſion to make obſervations of the *Baroſcope*, I have always taken notice of all theſe, when the *Mercury* was riſing, and conſequently in the *Increaſe* of the *Atmoſphere*'s Gravity: But on the contrary, when the *Mercury* has been low in the *Baroſcope* and ſo the *Atmoſphere*'s *Gravity* leſs, I have obſerved none of theſe Effects, but the remote Hills were clear and diſtinct (unleſs ſometimes a Cloud had fall'n down upon them) and no waving to be obſerved in the Air, nor Steams from the Waters. I know not whether I may add here a conjecture about the great Light, and the *Capræ ſaltantes*, which are ſome Nights to be ſeen in the North. I have taken notice of them uſually when the *Mercury* has been high in the *Baroſcope*, and then they appearing in that quarter of the Heavens where the Sun is at that time below the *Horizon*; this has given me Occaſion to think, that perhaps the Steams of Vapours may have aſcended ſo far in the *Atmoſphere* as to be beyond the Earth's Shadow in that part of the *Horizon*, and ſo by refracting the Beams of Light toward us to occaſion that Light, and thoſe *Capræ ſaltantes*. It may be conſidered alſo whether the red Skies in the Evening, which betoken fair Weather, do not proceed from the height of the Clouds occaſioned at that Time by the Increaſe of the *ſpecifical Gravity* of the *Atmoſphere*.

Now as to the falling down of the Vapours again, it is viſible by their gathering into thick and dark Clouds, by the falling down of Clouds and Miſts on the Tops of Hills, and thick Fogs in the Air, and by their dropping down into Rain, Snow, &c. and that theſe do uſually fall out only when the *Mercury* ſubſides a little, and conſequently when the *Atmoſphere*'s Gravity is leſs, is the conſtant Obſervation of thoſe who have had occaſion to take notice of the Changes of the *Baroſcope*.

Againſt this it may be objected, that it is obſervable many times that even when the *Mercury* in the *Baroſcope* is riſing there will be rain, and particularly ſometimes in *North-Eaſt* Winds. To this I anſwer, That if the Clouds have been carried for ſome while towards one quarter of the Heavens by the *Winds*, and then if the *Winds* do ſuddenly change into another quarter, theſe *Vapours* which were formerly ſcatter'd into ſmall particles, and ſo did eaſily float, are ſuddenly driven together into little drops, and ſo muſt needs fall down into *Rain*, and therefore the falling of *Rain* while the *Mercury* is riſing, is obſervable only upon the ſudden Change of contrary Winds.

But let us conſider in the next place, whether thoſe frequent *Commotions* in the *Air*, which we call *Winds*, may not be accounted for upon the ſame Principles. That known *Definition* of *Archimedes* is univerſally acknowledg'd, *Quod earum partium minus preſſæ expellantur a magis preſſis*; ſo that if there be any portion of a Fluid of a far leſs Preſſure and Reſiſtance than the reſt, the whole Fluid runs in a *Current* thither, till all be reduced to an *Æquilibrium*. Now it is evident that the Preſſure of the Air is not always the ſame, and 'tis very probable (which *Experience* will determine, by making joint *Obſervations* of the *Baroſcope* in ſeveral places of the *Earth* at the ſame time) that the *Air*'s *Gravity* is not alike chang'd throughout the whole *Atmoſphere* in an inſtant. So that when the Air becomes *ſpecifically lighter* in one place, or its Preſſure leſſened, the neighbouring parts of the *Atmoſphere*, whoſe *Weight* is not thus leſſen'd, run thither in a current, till the *Atmoſphere* thereabouts be reduc'd to an *Æquilibrium* again, and according to the portion of Air thus changed, and the leſſened or acquir'd degrees of the *Weight* and *Spring*, the Currents or Winds are ſtrong or weak, of a long or ſhort continuance. Now Obſervation and Experience do agree with this, the *Mercury* being found to ſubſide for the moſt part in the *Baroſcope* at the riſing of Winds; at leaſt it is obſerved to be in Motion, and either riſing or falling, and conſequently, there is a Change in the *Atmoſphere*'s Preſſure at that Time.

But the great difficulty remains ſtill, how to account for the different Changes of the *ſpecifick Gravity* of the *Atmoſphere*. Of this there can hardly be expected a ſatisfactory account, till we come to know the cauſe of Gravity in general, and of the Air's Weight in particular; and therefore I ſhall only here offer 2 or 3 Hints, which perhaps may incite others to conſider it more narrowly. And *firſt*, it is now almoſt generally acknowledg'd, that there muſt needs be a *Fluid* much more ſubtile than common *Air*, and of a far greater Preſſure than *Air*, which is the Cauſe of the Continuity and Coheſion of all Terreſtrial Bodies, and in which, the *Air* ſeems as it were to float, and to have the ſame Relation to it, as the Vapours do in, and have to the Air, and therefore if we could reach its Nature and Properties, it might be conſidered what Influence this may have upon the Change of the Air's Gravity. Or *ſecondly*, ſeeing the Infuſion of one Liquor into another, in *Chymical Preparations*, will alter its *ſpecifical Gravity*, ſo that the Bodies which were formerly born up in it, will fall down and be precipitated, as the particles of Gold floating thro' *Aqua Regis* will be precipitated by the Infuſion of another Chymical Liquor, it may be conſidered, whether Plenty of Nitrous Steams, or ſome ſuch Mixture, may not alter the Air's *ſpecifical Gravity*. Or *3dly*, We may poſſibly come to a nearer Reſolution of this, by conſidering the Influence which the Heat and Cold have upon the Air's Spring. The Air you know has this peculiar Property, which is, not ſo much obſerved of other Fluids, that it is endued with *Elaſticity* as well as *Gravity*, and therefore we are to conſider what Influence the Change of its *Spring* may have upon the Change of its Weight; and it ſeems evident, that the increaſe of its Spring doth diminiſh its Weight, and the leſſening of its Spring will increaſe it; for upon the Increaſe of the Air's Spring, the Air is rarified and ſo a leſſer Portion of it preſſes upon the ſubjacent Fluid: But when it is leſſened the Air is condenſed, and ſo a greater Portion of it preſſes upon the ſubjacent body. For Example, let us ſuppoſe the ſpringy Particles of Air, to be like the ſpringy Hairs of Wool, or the Spring of a Watch; and that many Millions of Rows of them go to make up the Cylinder of Air, which from the top of the *Atmoſphere* preſſes upon the *Mercury* in the *Baroſcope*, and keeps it ſuſpended to the height of 30 *Inches*, let us ſuppoſe this Air rarified, ſo that all its ſpringy Particles expand themſelves, and therefore ſhut off of this Cylinder ſome thouſands of thoſe Rows; this Cylinder, being now made up of a far leſſer Number of thoſe Rows of Particles, muſt needs have a leſſer Preſſure upon the *Mercury*, ſo that it will ſubſide, perhaps to 29. And thus it continues till the Air's Spring be weakned, and ſo the Particles crowded again into narrower Room. Now if this be found to hold in the *Theory*, Experience ſeems very well to anſwer it: For I have hitherto obſerved, that in cold Weather, and ſharp Froſts, the *Mercury* riſes higheſt in the *Baroſcope*, and if the Foreign Meaſures agree with ours, it is uſually higher here than in *France*, or *Italy*.

I ſhall here after all ſubjoin two or three Obſervations, which may ſerve to confirm what has been ſaid. The firſt is of the courſe of the weather under or near the *Line*. I have read in the 2*d*. and 4*th* parts of *Purchas* his *Pilgrims*, (and I doubt not but later Travellers atteſt the ſame Truth) That, in *Braſil*. and *Guiana* in *America*; in *Guinea*, *Congo* and *Ethiopia* in *Africa*, in the *Eaſt-Indies*, and the *Maldive* Iſlands; they have almoſt continual Floods of Rain from about the beginning of *May* to the end of *Auguſt*, which they call their Winter, and the reſt of the months of the year fair and clear weather, which they call their Summer: So that when the Sun is neareſt to them, they have conſtant Rains, and when remoteſt fair weather. And this I impute, amongſt other cauſes, to the extraordinary rarefaction of the Air, and leſſening of its *ſpecifical Gravity* there at that Time, ſo that the Vapours in the neighbouring parts of the Air, do all flow thither and deſcend as it were in Floods of rain. And as this is reckoned to be the Cauſe of the Inundation of the *Nile*, and ſome other Rivers, ſo perhaps this may be the Reaſon alſo, why thoſe Countries which are neighbouring to them, and ſomewhat remoter from the *Line*, ſuch as *Egypt*, and the like, have ſeldom or never any rain.

My ſecond Obſervation is of the *Baroſcope*, *viz*. That when the Wind is North, North-eaſt, or North-weſt, the *Mercury* ever riſes, and ſo the Air is heavier; but when the Wind comes from the South, South-eaſt, or South-weſt, it falls, and ſo the Air's Gravity is leſs: by which we may ſee what Influence the Cold and Heat have upon the Air's weight; and you know a cold Wind is ſaid to drive the Sails of a Ship much more forcibly than a warm.

My third Obſervation is of an Experiment of the honourable Mr. *Boyle*; n.6.p.2048.
I made, *ſaith he*, by Diſtillation a Blood-red Liquor, which chiefly conſiſted of ſuch ſaline ſpirituous Particles as may be obtained from the Maſs of Blood in human Bodies; this Liquor is of ſuch a Nature, that if a Glaſs Viol about half filled with it, be kept well ſtopt, the red Liquor will reſt as quietly as any ordinary one, without ſending up any ſmoak; but if the Viol be unſtopt, ſo that the external Air be permitted to come in, within a quarter of a Minute or leſs, there will be elevated a copious white Smoke, which will not only fill the upper part of the Glaſs, but plentifully paſs out into the open Air, till the Viol be again ſtopped. *And a little after he adds*, If the unſtopt Viol were placed in our *Vacuum*, it would not emit any viſible Steams at all, nor ſo much as appear in the upper Part of the Glaſs that held the Liquor; whereas when the Air was by Degrees reſtor'd at the Stop cock, the returning Air would preſently raiſe the Fumes, firſt into the vacant part of the Viol, whence they would aſcend into the Capacity of the Receiver; and likewiſe when the Air that was requiſite to ſupport them was pumped out they alſo accompanied it, as their unpleaſant Smell evinced, and the red Spirit, tho' it remained unſtopped, emitted no more Fumes n. 171. p.
till the new Air was let in again. *So far He*. Such you ſee was the Pro- 1000.
portion between the Gravity of the Vapours of this red Liquor and the Air, that the Air being in its ordinary Degree of Gravity, theſe Vapours did aſcend: but the Air's Gravity being much leſſened in the Receiver, by the pumping out a great deal of it, and ſo expanding the Spring of the reſt, It was not able to elevate thoſe Vapours.

By Dr. Wallis ib. p. 1002.

2. That there is in our Air a Body more ſubtile than are the Fumes and Vapours mingled with it in our lower Region, and which with it do make up that heterogeneous Mixture which we commonly call Air, I think to be very certain: But whether that ſubtile Body, be (as Dr. *Garden* ſeems to ſuppoſe) much heavier, than our common Air, I much doubt; and do rather think it not, not having hitherto obſerved any cogent Experiment, either to prove it heavy or elaſtick: But it may, for ought I know be void as well of Weight as Spring; and, what we find of either, in our common Air, may be attributed to the other Mixtures with it. For the Air being of a different Gravity, in different times and places (ariſing I ſuppoſe from the different kinds and quantities of the Fumes and Vapours and other Particles which are Ingredients in it, and the different force of the Sun's heat acting thereupon, increaſing or allaying the Spring thereof, and otherwiſe) we are therefore to conſider of the Air as a Fluid, whoſe parts are in ſome places heavier, and others lighter. And therefore much of a like Nature as if they were different Fluids, of different *ſpecifick* or intenſive Gravity, one from the other.

Now when ſeveral Fluids, or ſeveral parts of a Fluid, are thus of different Weights, they will (from the general Nature of heavy Fluids,) when undiſturbed, change Places with one another, till the heavier becomes loweſt, and the lighter higheſt.

And this, not only as to the minuter Parts; it is obſerved in Chimical Precipitations, or the ſinking of Sand in Water, or its ſmaller earthy Particles which ſubſide in a muddy Sediment, and the like of other Liquors when at reſt, and the Atoms (as they were wont to be called) flying in the Air when diſturbed, but ſubſiding in the form of Duſt when at reſt, all which, according as they be ſmaller, do (*cæteris paribus*) ſubſide more ſlowly: But much more as to larger Parcels; as when Oyl, Wine, Water, Beer, or other the like Liquors, are put together in the ſame Veſſel, as will be obſervable to the Eye, eſpecially when their Colours are conſiderably different.

And the ſame will happen, if ſome Parts of the ſame Liquor, do accidentally acquire, by Expanſion, or otherwiſe, a greater Degree of Lightneſs than the other Parts, thoſe lightned Parts aſcending, the heavier ſubſide; as when Water, Beer, or other thin Fluids, be gradually heated by a Fire underneath, the lower Parts being firſt warmed, aſcend to the Top, while the colder and heavier ſubſide; whence we find in ſuch Caſes that Bubbles do ariſe, and that at the Top is warmer than that at the Bottom: But in caſe what is warmed be of a thicker Conſiſtence, ſo as that the Parts cannot readily ſhift Places, that at the Bottom will be hotter; and in Caſe it be heated by Fire over it, there will (I ſuppoſe) be no ſuch Bubbling, (or not ſo much of it,) that at the Top being firſt heated.

From ſuch Conſiderations as this, Dr. *Garden* doth well obſerve, that ſome Parts of the Air being thus, by Rarefaction, or increaſing the Spring thereof, or otherwiſe, become lighter than others; theſe heavier parts, ruſhing into the Places of thoſe lighter, may cauſe a Wind as from ſuch Parts; (in like manner as, on a like Occaſion, a Tyde or Current would ariſe in Water;) and other Accidents of a like Nature. And contrariwiſe, on a contrary Occaſion.

And this I take to be very true, (though ſuch Accidents happening very variouſly and uncertainly, will cauſe ſuch confuſion of Motions, and diſturbance of each other, that it will be hard to reduce them to a regular Adjuſtment.)

But I add thereunto, that the Earth's diurnal Motion compounded with its Annual, (if we admit that *Hypotheſis*, as moſt do now a-days) the one in ſome parts accelerating, in others retarding the other; and its Difference in different times of the Year, by Reaſon of the Obliquity of the *Zodiack* to the *Æquinoctial*) and in different times of the Month (becauſe of the Moon's different Poſition, which is an Appendance to the Earth's Motion, and doth thereby differently affect it,) and according to the different Place of the Earth and Moon, as to the *Aphelion* or *Perihelion* of the one, and the *Apogæum* or *Perigæum* of the other, ſeem to me to be of much greater Conſideration, not only as to the *Ebbing* and *Flowing* of the Sea, but as to the Winds alſo: eſpecially the *Breezes* and *Trade-winds*, which at certain Times of the Day, or of the Year, or of the Month, are obſerved to blow conſtantly, or moſt frequently, from ſuch or ſuch a Coaſt.

And I am not ſure, that the Body of Earth and Water (or terraqueous Globe) is exactly ſpherical, allowing only for the ſmall Inequalities of Hills and Dales, which in a Body of that Greatneſs are inconſiderable, but may have ſomewhat of an *Oblong Spheroid*, having a longer Axis from *Pole* to *Pole*, than at the *Æquator*. And tho' this cannot be much, becauſe of the Earth's Shadow in the Moon's Eclipſe appearing circular; and the Deſcent of heavy Bodies being always (as to Senſe) in a Perpendicular to the *Horizon*; yet if it be but little, this, with the Compound Motions before mentioned, will give the Air a conſiderable Diſturbance.

To which I may add alſo, that we are not ſure that the Seas and Continents, which are of very different comparative Weights, Earth being heavier than Water, are ſo adequately adjuſted the one to the other, as that its Center of Gravity, by which a Plain paſſing divides it into Parts Æquiponderant, is the ſame with its Center of Magnitude, by which it is divided into Parts equally great, which, if it happen to be otherwiſe, will with the reſt make the Confuſions of the Air's Motions yet greater.

From the comparative Weight or Lightneſs of the Air at different times, he deduceth alſo the riſing or falling of Vapours in it. As if when ſuch Fumes or Vapours, or other the like Matters are lighter than the Air, they ought, according to the exact Rules of *Hydroſtaticks*, to aſcend therein; but when heavier than ſo, to fall down. And this certainly (*cæteris paribus*) is to be admitted alſo. Only I add thereto, that theſe *ſtatick Principles* do chiefly take Place, when things are otherwiſe at Reſt and Quiet: But when they are in Commotion, it is many times much otherwiſe. And in ſuch Caſes, we muſt, beſides the reſpective Gravity take into Conſideration the Force, Impulſe, or Impetus, that is ſuperadded to the reſpective Gravity of the Parts of Matter. Thus, if a Bottle be ſhaken, the Sediment at the Bottom, tho' heavier, and for which Cauſe it did before ſubſide, will be mingled with the ſupernatant (finer and lighter) Liquor. And if a Room be ſwept, it will, as we uſe to ſpeak, make a Duſt, that is, the ſmall earthy

Particles of Duſt will riſe and mingle with the Air, not becauſe they be lighter than it, for we ſee that at leiſure they will ſubſide again; but becauſe by a Force upon them they be put into Motion. And this I take to be the cauſe of Fumes, Vapours, and other like Matters, (moſt of them) which aſcend in the Air, not becauſe lighter than it, but becauſe impell'd upward out of the Bowels of the Earth, or from the ſuperficial Parts of it, either by ſome ſubterranean Heats, or other Ferments, that put them into Motion, and force them upward, where they remain ſuſpended in the Air, ſo long as that Force continues, or the Force of others ſent after them on the like Errand, which rather impels them farther, than gives them leave to fall, till either ſuch Force abate, or the great Weight of ſo many things ſuſpended doth overpower, not only the Air's Weight, but the Strength of that that impelled them. And that there are ſuch Fumes, and other like matter projected upwards from the Bowels of the Earth, and ſome of them with great Violence, is undeniable, not only from Earthquakes and other Eruptions, with great Noiſes, as well of Vapours, as of burning Mountains, but even poyſonous Steams, and others, in Mines and bubbling Springs, where Bubbles of Air are ſeen to make their Paſſage through the Water, and other Perſpirations of Air or Vapour, through Cranies, or ſmall Paſſages of the Earth, diſcoverable by Steams, whereof ſome will take Fire at the Light of a Candle, or by the moving of Leaves, and other light Things laid on the Mouths of ſuch private Paſſages, and by many other Means. And to ſuch Cauſes I do principally attribute the *Origin* of *Winds*, and the Aſcent of moſt other Things, which from this lower World, mount into the Air: And without this, the comparative Gravity of the Air and them, would give us but a lame Account of them.

There is yet another Notion ſuggeſted, which is alſo very conſiderable as to this Affair, which is the weakning or ſtrengthning the Spring of the Air. That Water hath, of it ſelf, nothing of Spring or Elaſticity, otherwiſe than by reaſon of ſome airy Parts, or other elaſtick Bodies, which may be included within it, it generally held, at leaſt none conſiderable, ſuch as by any Experiments hitherto made, can be clearly evinced ſo to be. But that the Air, (ſuch Air at leaſt as is the common Air which we are converſant with) is elaſtick, is I think out of doubt: the Experiments which prove its Spring being ſo many and evident, beyond Exception. And that this Spring of the Air is ſometimes ſtronger, and ſometimes weaker, I think, is undoubted alſo; And that the Spring of the Air is ſtrengthned both by Compreſſion and by Heat, but in a different Manner. If the ſame Quantity of Air be compreſſed into a leſſer Room, the Spring is certainly ſtronger, as is undoubtedly ſeen in the Wind-Gun, and other compreſſive Engines. And the ſame Quantity of included Air in a cloſe Veſſel, ſo as not to communicate with the external Air, will by Application of Heat to it have its Spring ſtrengthned, and drive its Counterpoiſe farther off, or if need be, compreſs it, as is to be ſeen in *Thermoſcopes* of all ſorts.

If the Spring be ſtrengthned by Compreſſion, it is manifeſt that the intenſive Gravity muſt be thereby increaſed, becauſe the ſame quantity of Air, an conſequently of Weight, extenſively taken, is now contracted into a leſſe room, which therefore muſt be Intenſively heavier, (as being the ſame Weight in a leſſer Bulk.) Now this may poſſibly, as a greater Preſſure or Stronger Spring, force up the Vapours under it with a greater Impetus (according to the Notion I mentioned before) and ſo make them fly higher: (unleſs we ſhould ſuppoſe it may be relieved, by ſhortning the height of the *Atmoſphere* :) but not ſo as to make them lighter, but rather the contrary, as preſſing them cloſer: Much leſs to make them (as the Phraſe is,) *Specifically Lighter* than is the Air it ſelf (though thus Compreſſed,) and it leaves leſs room to receive them between the particles of the Compreſſed Air, as being now thruſt cloſer together.

If the Spring be Strengthned the other way; ſo as by Heat it uſeth to be: This doth rather diminiſh its Intenſive Gravity, by thruſting its parts further aſunder, and ſo poſſeſſing a larger Room. Now in caſe this Air be, by a cloſe Veſſel, confined ſo as not to Expand upward; it will certainly preſs the harder on the ſtagnant Quick-ſilver under, and make that in the Tube Riſe higher. But in caſe it be unconfined, as in the open Air, it may as well relieve it ſelf upward, by making the *Atmoſphere* in this part ſo much the higher.

Nor is there any neceſſity, as to the ſubjacent parts, that the *Atmoſphere* ſhall be every where of the ſame Height. But the Laws of *Staticks*, as to the ſubjacent Parts, be equally preſerved without it, the greater Altitude compenſating for the Levity of the Parts, as when a portion of the Sea is covered with a Fleet of Ships, the under Parts are equally Preſſed, partly by Water, and partly by Ships, though the Tops of the Ships over ſome parts be higher than the Surface of the Water over others. Only, in ſuch Caſe, the upper Part of the *Atmoſphere*, being Fluid, may Flow collaterally over the other Parts on either ſide if lower. And ſo, at leiſure, (if thus remaining otherwiſe undiſturbed) reduce it ſelf to an equal Height in all Parts. Like as the Sea would do, in a perfect Calm, though otherwiſe its Waves and Billows are far from being in all Places perfectly plain and even.

But, however, though the Spring fortified by Heat, may thus relieve it ſelf upwards, (yet becauſe it preſſeth every way,) it muſt endeavour the like downward alſo, and thereby preſs harder what is under it; and becauſe it will require time to work upward gradually before the effect reach the Top of the *Atmoſphere*; and becauſe by ſuch Dilatation of its Parts, more room is left in the Intervals to receive what is forced: 'Tis reaſonable to believe that in ſuch Caſes, the preſſed Vapours (*cæteris paribus*) may Riſe more copiouſly, than when the Spring of the Air, (for want of Heat) is leſs Strong. The rather becauſe the ſame Heat which thus fortifies the Spring of the Air, doth alſo Rarify the Vapours and make them Lighter: and may alſo fortify the Subterraneal Heat (or what ever elſe it is,) that Drives them up. Notwithſtanding all which, we have more Rains in Winter; which ſhould argue, that more Vapours do then ariſe to ſupply them.

But I ſuſpect that in this whole buſineſs (of Strengthing the Spring) there may be a fallacy put upon us: And what we think to be done upon the open Air, is indeed done upon the Quick-ſilver; or rather upon the Air latent therein. My meaning is this; we find that in very Hot Weather, and alſo in Froſty Weather, the Quick-ſilver in the Tube commonly ſtands very high; from whence we are apt to conclude, that therefore the outward Air preſſes very hard on the Stagnant Quick-ſilver, without the Tube: Wherein I am not ſatisfy'd; for we are to conſider, that, in filling the Tube with Quick-ſilver, before it be inverted, if great care be not uſed to cleanſe it from Air, may Airy particles will remain mixed with it; which, while their Spring is weak, are eaſily preſſed by the weight of the Quick-ſilver ſo cloſe as hardly to be diſcerned otherwiſe than by the Effect: But when, by the external Heat, their Spring is ſtreugthned, they Expand themſelves, and cauſe the Quick-ſilver, wherein they are, to ſwell in Bulk, without increaſing its weight; and conſequently to ſtand higher though not to Preſs heavier.

And the ſame account, perhaps, may ſerve for its ſtanding ſo high in Froſty Weather. Water we know, though it contract with Cold, yet when it comes to Freeze, doth Expand it ſelf. (Which makes Ice lighter than Water, and to ſwim on the Top of it.) Now whether this be purely of it ſelf, or (in part at leaſt) from the Particles of Air lodged in it, may not perhaps be ſo eaſie to determine. However, if there be the like Effects on Air, as on Water, (namely that it Expands with Freezing,) or if in the Quick-ſilver there be lodged particles of Water as well as of Air; we have, either way, an account of this *Phænomenon.* For, then the ſmall Particles, whether of Air, or of Water, lodged in the Quick-ſilver being thus Expanded by Freezing, will make the Quick-ſilver ſwell, and ſo ſtand higher, without increaſing its weight; and conſequently, without arguing a greater weight of External Air preſſing on the ſtagnant Quick-ſilver.

The Circu'ation of Watry Vapours; by Mr. Edm. Halley, n. 192. p. 468.

XXXIV. I have formerly attempted to explain the manner of the riſing of Vapours by Warmth, by ſhewing that if an Atom of Water were expanded into a Shell or Bubble ſo as to be ten times as big in Diameter as when it was Water, ſuch an Atom would become *Specifically Lighter* than Air, and Riſe ſo long as that *Flatus*, or warm Spirit, that firſt ſeparated it from the Maſs of Water, ſhall continue to diſtend it to the ſame degree; and that Warmth declining, and the Air growing cooler and withal *Specifically Lighter*, the Vapours conſequently ſhall ſtop at a certain Region of the Air, or elſe Deſcend, which may happen upon ſeveral Accounts, as I ſhall by and by endeavour to make out. Yet I undertake not, that this is the only Principle of the Riſe of Vapours, and that there may not be a certain ſort of matter whoſe *Conatus* may be contrary to that of Gravity; as is evident in Vegetation, wherein the tendency of the Sprouts is directly upwards, or againſt the Perpendicular. But whatever is the true cauſe, it is in fact certain, that Warmth does ſeparate the particles of Water, and emit them with a greater and greater Velocity, as the Heat is more and more Intenſe, as is evident in the Steam of a Boiling Cauldron, wherein likewiſe the Velocity of the Aſcent of the Vapours does viſibly Decreaſe till they diſappear, being diſperſed into and aſſimulated with the ambient Air.

Vapours being thus raiſed by Warmth, let us for a firſt Suppoſition put, that the whole Surface of the Globe were all Water very deep, or rather that the whole Body of the Earth were Water, and that the Sun had his Diurnal courſe about it: I take it, that it would follow that the Air of it ſelf would Imbibe a certain quantity of Aqueous Vapours, and Retain them like Salts diſſolved in Water; that the Sun warming the Air, and raiſing a more plentiful Vapour from the Water in the Day time, the Air would Suſtain a greater proportion of Vapour, as warm Water will hold more diſſolved Salts, which upon the abſence of the Sun in the Nights would be all again diſcharged in Dews, analogous to the Precipitation of Salts on the cooling of the Liquors; nor is it to be believed that in ſuch caſe there would be any diverſity of Weather, other than periodically, every Year alike, the mixture of all Terreſtrious, Saline, Heterogeneous Vapours being taken away; which as they are variouſly compounded, and brought by the Winds, ſeem to be the Cauſes of thoſe various Seaſons which we now find. In this caſe the Airy Regions, every where at the ſame height, would be equally repleniſhed with the proportion of Water it could contain, regard being only to be had to the different degree of warmth, from the nearneſs or diſtance of the Sun; and an Eternal Eaſt-wind would blow all round the Globe, inclining only to the ſame ſide of the Eaſt, as the Latitude doth from the *Æquator*; as is obſerved in the *Ocean* between the *Tropicks*.

Next let us ſuppoſe this Ocean interſperſed with wide and ſpacious Tracts of Land, with high Ridges of Mountains; ſuch as the *Pyrenean*, the *Alps*, the *Apennine*, the *Carpathian* in *Europe*; *Taurus*, *Caucaſus*, *Imaus*, and ſeveral others in *Aſia*; *Atlas* and the *Montes Lunæ*, with other unknown Ridges in *Africa*, whence come the *Nile*, the *Nigre*, and the *Zaire*; and in *America* the *Andes*, and the *Apalatean* Mountains: Each of which far ſurpaſs the uſual height to which the Aqueous *Vapours* of themſelves Aſcend, and on the Tops of which the Air is ſo Cold, and rarified, as to retain but a ſmall part of thoſe Vapours that ſhall be brought thither by the Winds. Thoſe Vapours therefore that are raiſed copiouſly in the Sea, and by the Winds are carried over the low Land to thoſe Ridges of the Mountains, are there compelled by the Stream of the Air to mount up with it to the Tops of the Mountains, where the Water preſently *Precipitates*, gleeting down by the Crannies of the Stone; and part of the Vapours entring into the Caverns of the Hills, the Water thereof gathers as in an *Alembick* into the Baſons of Stone it finds, which being once filled all the overplus of Water that comes thither runs over by the loweſt Place, and breaking out by the ſides of the Hills, forms ſingle Springs; Many of theſe running down by the Valleys, or Guts between the Ridges of the Hills, and coming to unite, form little *Rivulets* or *Brooks*; many of theſe again meeting in one common Valley, and gaining the plain Ground, being grown leſs rapid, become a *River*; and many of theſe being united into one common Channel, make ſuch *Streams* as the *Rhine*, the *Rhone*, the *Danube*; which latter one would hardly think the Collection of Water condenſed out of *Vapour*, unleſs we conſider how vaſt a Tract of Ground that

River drains, and that it is the ſum of all thoſe *Springs* which break out on the South ſide of the *Carpathian* Mountains, and on the North ſide of the immenſe Ridge of the *Alps*, which is one continued Chain of Mountains from *Switzerland* to the *Black Sea*. And it may almoſt paſs for a Rule, that the *Magnitude* of a *River*, or the Quantity of Water it Evacuates, is proportionable to the length and height of the Ridges from whence its *Fountains* ariſe. Now this *Theory* of Springs is not a bare *Hypotheſis*, but founded on Experience, which it was my luck to gain in my abode at St. *Helena*; where in the Night time on the Tops of the Hills, about 800 yards above the Sea, there was ſo ſtrange a Condenſation, or rather Precipitation of the Vapours, that it was a great Impediment to my Celeſtial Obſervation; for in the Clear Sky the Dew would fall ſo faſt as to cover, each half quarter of an Hour, my Glaſſes with little drops, ſo that I was neceſſitated to wipe them off ſo often, and my Paper, on which I wrote my Obſervations, would immediately be ſo wet with the Dew that it would not bear Ink: By which it may be ſuppoſed how faſt the Water gathers in thoſe mighty high Ridges I but now named.

Thus is one part of the Vapours blown upon the Land returned by the Rivers into the Sea, from whence they came. Another part by the Cool of the Night falls in Dews, or elſe in Rains, again into the Sea before it reaches the Land; which is by much the greateſt part of the whole Vapour, becauſe of the great Extent of the Ocean, which the Motion of the Winds does not traverſe in a very long ſpace of time: And this is the Reaſon why the Rivers do not return ſo much into the *Mediterranean* as is extracted in Vapour. A third part falls on the lower Lands, and is the *Pabulum* of *Plants*, where yet it does not reſt, but is again exhaled in Vapour by the Action of the Sun, and is either carried by the Winds to the Sea, to fall in Rain or Dew there; or elſe to the Mountains to be there turned into Springs: And though this does not immediately come to paſs, yet after ſeveral Viciſſitudes of riſing in Vapour and falling in Rain or Dews, each particle of the Water is at length returned to the Sea, from whence it came. Add to this, that the Rain-water, after the Earth is fully ſated with moiſture, does, by the Valleys or lower parts of the Earth, find its way into the Rivers, and ſo is compendiouſly ſent back to the Sea. After this manner is the *Circulation* performed: And I doubt not but this *Hypotheſis* is more reaſonable, than that of thoſe who derive all Springs from the Rain-waters, which yet are perpetual and without diminution, even when no Rain falls for a long ſpace of time: Or than that that derives them from a Filtration, or *Percolation* of the Sea-waters through certain imaginary Tubes or Paſſages within the Earth, wherein they loſe their Saltneſs; This beſides many others labouring under this principal Abſurdity, that the greateſt Rivers have their moſt copious Fountains fartheſt from the Sea, and whether ſo great Quantities of freſh Water cannot reaſonably be derived any other way than in Vapour. This, if we may allow *Final Cauſes*, ſeems to be the deſign of the Hills, that their Ridges being placed through the midſt of the *Continents*, might ſerve as it were for *Alembicks*, to diſtill Freſh Water for the uſe of Man and Beaſt, and their

Heights to give a Deſcent of thoſe Streams to run gently, like ſo many Veins of the *Macrocoſm*, to be the more beneficial to the Creation. If the Difference between Rain and Dew, and the Cauſe why ſometimes 'tis Cloudy at other times Serene, be enquired, I can offer nothing like a proper Solution thereof, only with ſubmiſſion to propoſe Conjectures, which are the beſt I can find, *viz.* That the Air being heap'd up with the meeting of two contrary Winds, when the Mercury is high, the Vapours are the better ſuſtained and kept from Coagulating or Condenſing into Drops, whereby Clouds are not ſo eaſily generated: And in the Night the Vapours fall down ſingle as they aroſe in *Imperceptille* Atoms of Water. Whereas when the Mercury is low, and the Air rarefied by the Exhauſtion thereof, by two contrary Winds blowing from the Place, the Atoms of Air keep the Vapours not ſo well ſeparated, and they Coaleſce into Viſible Drops in the Clouds; and from thence are eaſily drawn into greater Drops of Rain. To which 'tis poſſible, and not improbable, that ſome ſort of Saline or Angular particles of Terreſtrial Vapour being immixt with the Aqueous, which I take to be Bubbles, may cut or break their Skins or Coats, and ſo contribute to their more ſpeedy Condenſation into *Rain.*

The Cauſe of Trade Winds, *by Dr.* M. Liſter, n. 156. p. 494.

XXXV. The *Trade* or *Tropick Winds* ſeem in great part to ariſe from the daily and conſtant Breath of the *Sargoſſe* or *Lenticula Marina*, which grows in vaſt Quantities from 36 to 18 Degrees Northern Latitude, and elſewhere upon the deepeſt Seas; becauſe the Matter of that Wind, coming (as we ſuppoſe) from the Breath of only one Plant, it muſt needs make it conſtant and Uniform; whereas the great Variety of Plants and Trees at Land muſt needs furniſh a Confuſed Matter of Winds. Again the *Levant Breezes* are briskeſt about Noon, the Sun quickning the Plant moſt then, cauſing it to breath faſter and more vigorouſly; and that Plants moſtly languiſh in the Night is evident from many of them, which contract themſelves and cloſe at that time; alſo from the Effects of our Winters upon them, which cauſe them to caſt both Fruit and Leaves too; whereas they are ſaid (the ſame Plants for Kind) univerſally to Flouriſh all the Year alike within the *Tropicks.*

As for the Direction of this *Breeze* from Eaſt to Weſt, it may be owing to the general *Current* of the Sea; for a gentle Air will ſtill be led with the Stream of our Rivers, for Example. Again every Plant is in ſome meaſure an *Heliotrope*, and bends it ſelf and moves after the Sun, and conſequently emits its Vapours thitherward; and ſo its Direction is in that reſpect alſo owing in ſome meaſure to the Courſe of the Sun.

The Cauſe of Winds; *and of the Change of* Weather; *by Dr.* Geo. Garden n. 175. p. 1148.

XXXVI. 1. It is generally known that there are continual Eaſtern Winds under the *Line*, which they call *Breezes*, and therefore the accounts of *Spaniſh* Voyages bear, that in their going to the *Weſt-Indies* they ſail Southwards from *Spain*, along the Coaſt of *Africk*, till they be beyond the *Tropick* of *Cancer*, within 20 *Deg.* of the *Line*, where they preſently find an Eaſterly Wind, and ſo they ſail on Weſtwards with full Wind, ſo as they have ſcarce any need to touch their Sails in the whole Voyage: And this they give as the reaſon why the Voyage from *Spain* to the *Weſt-Indies* is ſhorter, more eaſie, and more aſſured, than the return to *Spain.* In the

South Sea alſo, going from *New Spain* or *Peru* to the *Philippines* or *China*, their Voyage is eaſie, Sailing always from Eaſt to Weſt near the *Line*, where the Eaſterly Winds blow in their Poop. *Acoſta* reports, that in the Year 1584, there went a Ship from *Callea* in *Lima* to the *Philippines*, which ſailed 2700 Leagues without ſight of Land, and this in two Months, their Courſe being almoſt under the *Line*.

Now theſe continual Eaſterly Winds between the *Tropicks*, I ſuppoſe to proceed both from the Motion of the Earth and the Vertical Influences of the Sun, after this manner. As you know the Vaſt Fluid and Æther, in which the Earth floats in its Annual Motion, moves forward with the Earth in that Motion, or rather carries the Globe of the Earth along with it; even ſo the *Atmoſphere*, and a large Vortex of Æther beyond the Moon, goes round with the Earth in its Diurnal Motion, which tho' according as it is removed from the Earth it may be proportionably ſlower in its Motion, yet that portion of the *Atmoſphere*, which is neareſt the Earth and ſurrounds it, may be ſuppoſed to keep equal pace with the Earth in its Motion; and if there were no changes in the *Atmoſphere*'s Gravity, I ſuppoſe it would always go along with the Globe of the Earth from Weſt to Eaſt in an Uniform Motion, which would be wholly inſenſible to us. But that portion of the *Atmoſphere* under the *Line*, being extreamly rarefied, its Spring expanded, and ſo its Gravity and Preſſure much leſs than the neighbouring parts of the *Atmoſphere*, and conſequently uncapable of the Uniform Motion to the Eaſt, it muſt needs be preſt Weſt-wards, and make that continual *Breeze* from Eaſt to Weſt between the *Tropicks*.

2. The ſame accounts bear, that on this ſide the *Tropick*, about 28 or 30 *deg*. there are to be found conſtant weſterly Winds, and therefore the *Spaniſh* Fleets from the *Weſt-Indies* do not return the way they went, but thoſe both from *Peru*, and *New-Spain*, Sail along the Coaſt Northward till they touch at *Havana* in *Cuba*, and being joyn'd together there, they ſeek their height without the *Tropicks*, where preſently they find weſterly Winds which ſerve them till they come in view of the *Azores*, and from thence to *Sevil*. In like manner in the *South-Sea*, thoſe which return from the *Philippines*, or *China*, to *Mexico*, to the end they may recover the Weſtern Winds, mount a great height till they come right againſt the Iſland of *Japan*, and diſcovering *California* they return by the Coaſt of *New-Spain* to the Port of *Acapulco*, from whence they parted. So that tho' they Sail eaſily from Eaſt to Weſt, in both Seas, within the *Tropicks*, for that the Eaſtern Winds reign there; yet returning from Weſt to Eaſt they muſt ſeek the Weſtern Winds without the *Tropicks* in the height of 2 *Degrees*.

Now the Reaſon of this ſeems to me clearly deducible from the forme for the Preſſure of Air between the *Tropicks* being continually leſs tha the neighbouring parts of the *Atmoſphere*, and ſo conſequently by the preſſed Weſt-ward, way being thereby given to the neighbouring Air f ſome *Deg*. without the *Tropicks*, its motion from Weſt to Eaſt is proport onably increas'd beyond that uniform motion it would have if the who

Atmoſphe

Atmoſphere were of an equal Preſſure, and conſequently there will blow a conſtant Wind from Weſt to Eaſt for ſome *Degrees* beyond the *Tropicks*.

3. Thoſe eaſterly Winds between the *Tropicks*, by what I can collect from the accounts of Eaſtern Voyages, do not blow conſtantly from the ſame Point, nor directly from the Eaſt; but for the one half of the Year, *viz.* from *April* to *November* or thereabouts, they come from the South Eaſt, and for the other half of the Year *viz.* from *November* to *April*, they blow from the North Eaſt. And theſe I ſuppoſe they call their *Monſoons*, and *Trade-Winds.* Hence it is that they who Sail from *China*, *Japan*, &c. to *Bantam*, muſt wait the Northerly *Monſoon*, which falls between *November* and *April*; and they who return from *Bantam*, muſt go back again when the Southerly *Monſoon* comes, which is between *April* and *November*; and the *Currents* of the *Sea* are ſaid to obſerve the ſame Motion, and Changes, with the Winds. I know not whether theſe *Monſoons* do blow exactly from the ſame Points, in all parts, for it's like where there are Bays, High-lands, and Iſlands, *&c.* the *Monſoons* may Blow from different Points; but this is chiefly to be underſtood of open Seas.

Now theſe *Monſoons* I think may be eaſily accounted for from what has already been ſaid, anent the Cauſe of the continual Eaſterly Winds between the *Tropicks*, for ſeeing the leſſening of the Air's Preſſure under the *Line*, and the Preſſure of the Neigbouring parts of the *Atmoſphere* thereupon, occaſion theſe continual *Breezes*, if the Sun were conſtantly in the *Æquinoctial Line*, it is like the Wind would Blow ſtill directly from the Eaſt, but in that he is the one half of the Year on the one ſide of the *Line*, and the other half on the other, there muſt of neceſſity follow a Change of theſe *Breezes* into ſtated *Monſoons*. For imagine the *Atmoſphere* to be divided into two equal Hemiſpheres by the *Æquinoctial* Plane, if the Sun were always in the Plane, there would be ſtill an Equal Preſſure from both theſe Hemiſpheres upon the Air under the *Line* and the *Breeze* ſhould be directly from the Eaſt. But now when the Sun comes on the North ſide of the *Line*, as far as the *Tropick* of *Cancer*, and back again, there is not an Equal Balance, but the Preſſure of the Southern Hemiſphere of the Air muſt needs be greateſt, and conſequently the *Breeze* muſt Blow all that Seaſon from the South Eaſt, and when the Sun returns again to the Southward of the *Line*, as far as *Capricorn*, and back again, the Preſſure of the Northern Hemiſphere muſt needs preponderate, and make the Wind Blow all that Half Year from the North Eaſt. And this ſeems to accord very well with Experience, for their Northern *Monſoons* are in our Winter Seaſon, when the Sun is in the Southern *Signs*, and their Southern ones in our Summer when he is in the Northern *Signs*.

4. The Rivers of *Indus* and *Ganges*, where they enter the Ocean, do contain between them a large *Cherſoneſus*, which is divided in the middle by a Ridge of high Hills, which they call the *Gate*, which run along from Eaſt to Weſt and quite thorough to Cape *Comori*. On the one ſide is *Malabar*, and on the other *Coromandel*. On the *Malabar* ſide between that Ridge of Mountains and the Sea, it is after their appellation Summer from *September* till *April*; In which time it is always a clear Sky, without once,

or

or very little, Raining. On the other ſide the Hills, on the Coaſt of *Coromandel*, it is at the ſame time their Winter, every Day and Night yielding abundance of Rain. And from *April* to *September* it is on the *Malabar* ſide, their Winter, and on the other ſide their Summer: So that in little more than 20 Leagues Journey in ſome Places, as where they croſs the Hills to St. *Thomas*, on the one ſide of the Hill you Aſcend with a fair Summer; on the other you Deſcend with a Stormy Winter. The like is ſaid to be at Cape *Fazalgate* in *Arabia*. And Dr. *Trapham* relates the ſame of *Jamaica*, intimating that there is a Ridge of Hills which runs from Eaſt to Weſt thro' the midſt of the Iſland and that the Plantations on the South-ſide of theſe Hills have from *November* to *April* a continual Summer, whilſt thoſe on the North ſide have as conſtant a Winter and *è contra* from *April* to *November*.

From theſe and ſuch like accounts it ſeems evident, that a bare leſſening of the *Atmoſphere's* Gravity will not occaſion Rain, but that there is alſo needful either a ſudden Change of Winds, or a Ridge of Hills to meet the Current of the Air and Vapours, whereby the Particles of the Vapours are driven together, and ſo fall down into drops of Rain. And hence it is, that whilſt the Wind Blows from the North-Eaſt, *viz.* from *November* to *April*, there are continual Rains in the Northerly Plantations of *Jamaica*, and on the ſide of *Coromandel* in the *Eaſt-Indies*, becauſe the Winds beat againſt that ſide of the Hills; and ſo there is fair Weather on the other ſide of theſe Hills, in *Malabar* and the Southern Plantations of *Jamaica*, there being no Winds to drive the Vapours together. But in the Southerly *Monſoon*, *viz.* from *April* to *November*, *Malabar* and the Southerly Plantations of *Jamaica* have floods of Rains, the Wind beating againſt that ſide of the Hills, whilſt in *Coromandel* and the other ſide of *Jamaica* there is Fair and Clear Weather. The Maps make thoſe Mountains of *Gate* run South and North, and if ſo the *Monſoons* muſt Blow from other Points by reaſon of the neighbouring Countries and Iſlands or elſe this is not the true cauſe of theſe *Seaſons*.

This ſerves alſo to clear the *Singularity* of *Seaſons* in *Peru*, beyond any other parts of the Earth, and ſeems to be aſſigned by *Acoſta* as the Cauſe of it. *Peru* runs along from the *Line* Southwards about 100 Leagues. It is ſaid to be divided into three Parts, long and narrow, which they call *Lanos*, *Sierras* and *Andes*; the *Lanos*, or Plains, run along the *South-Sea* Coaſt; the *Sierras* are all Hills with ſome Vallies; and the *Andes*, ſteep and craggy Mountains. The *Lanos* have ſome ten Leagues in breadth, in ſome Parts leſs and in ſome more; the *Sierra* contains ſome 20 Leagues in breadth, the *Andes* as much, ſometimes more ſometimes leſs; they run in length from North to South, and in breadth from Eaſt to Weſt This Part of the World is ſaid to have theſe remarkable Things. 1. All along the Coaſt, in the *Lanos*, it Blows continually with one only Wind, which is South and South weſt, contrary to that which uſually Blows under the *Torrid Zone* 2. It never Rains, Thunders, Snows, or Hails, in all this Coaſt, or *Lanos*, tho' there falls ſometimes a ſmall Dew. 3. Upon the *Andes* it Rains almoſt continually, tho' it be ſometimes more

Clear than other. 4. In the *Sierra*, which lies betwixt both the Extreams, it rains from *September* to *April*, but in the other Seaſons it is more clear, which is when the Sun is fartheſt off, and the contrary when it is neareſt. Now the Reaſon of all ſeems to be this. The Eaſtern *Breezes* which blow conſtantly under the *Line*, being ſtopt in their Courſe by the *Sierras* and *Andes*, and yet the ſame *Breezes* being to be found in the *South-Sea* beyond *Peru*, as appears by the eaſy Voyages from *Peru* to the *Philippines*, a Current of Wind blows from the South on the Plains of *Peru*, to ſupply the *Eaſtern Breeze* in the *South-Seas*. and there being but one conſtant Gale in theſe Plains, and no contrary Winds, nor Hills for it to beat upon, this ſeems to be the Reaſon why the Vapours are never, or very ſeldom, driven into Rain. And the *Andes* being as high perhaps in many Places as the Vapours aſcend in the higheſt Degree of the *Atmoſphere*'s Gravity, this may probably be the Reaſon why the Eaſtern *Breeze*, beating conſtantly againſt theſe Hills, occaſion Rains upon them at all Seaſons of the Year. And the *Sierras* being it ſeems lower than the *Andes*, therefore from *September* to *April*, when the Sun is neareſt, and ſo the *Atmoſphere*'s Gravity leſs, and the Vapours lower, they are driven againſt the *Sierras* into Rain.

6. The Cauſes of thoſe particular, various uncertain, and unconſtant Winds, which do blow in the Countries without the *Tropicks*, and that moſt frequently in mountainous Places, and more ſeldom in great Planes, ſuch as *Poland*, I cannot ſo eaſily conjecture: but thoſe general Winds which uſually fall out every where about both *Equinoctials*, ſeem to proceed from ſome general Cauſe: and this I take to be the Change of the *Monſoons*, and *Trade Winds*, about theſe Times between the *Tropicks*. For there muſt needs be about theſe Seaſons a Change of the Balance of the *Atmoſphere*, according to what I have diſcourſed on the third Head, and this I think cannot but occaſion ſtrong Winds over all the Earth.

By Mr. W. Molyneux, n. 177. p. 1237.

2. Dr. *Garden* endeavours to explain and give an Account of the *Trade-winds* within the *Tropicks*, from the different Gravity of the *Atmoſphere* at divers times of the Year. And yet it is aſſerted by Dr *Liſter*, That the *Mercury* is not affected with the Weather, or very rarely, let it be cloudy, rainy, windy or ſerene, in St. *Helena* or the *Barbadoes*, and therefore probably not within the *Tropicks*, unleſs in a violent Storm or Hurricane. Now if the *Mercury* move little or nothing in the *Baroſcope*, 'tis likely there is little or no Change in the Gravity of the *Atmoſphere*, within the *Tropicks*.

Vid. Sect. X. 1.

By Mr. Halley, n. 183. p. 153.

3. The univerſal *Ocean* may moſt properly be divided into three Parts; *viz*. 1. The *Atlantick* and *Æthiopick* Sea. 2. The *Indian Ocean*. 3. The great *South-Sea*, or the *Pacifick Ocean*.

1 In the *Atlantick* and *Æthiopick* Seas, between the *Tropicks*, there is a general Eaſterly wind all the Year long, without any conſiderable variation; excepting that it is ſubject to be deflected therefrom, ſome few Points of the Compaſs, towards the North or South, according to the Poſition of the Place.

1. Near the Coaſt of *Africa*, aſſoon as you have paſſed the *Canary Iſles*, you are ſure to meet a freſh Gale of *N. E.* Wind, about the Latitude of 28°. North, which ſeldom comes to the Eaſtwards of the *E. N. E.* or paſſes the *N. N. E.* This Wind accompanies thoſe bound to the Southward, to the La-

titude of 10°. North, and about 100 Leagues from the *Guinea* Coaſt, where till the 4° of North Latitude they fall into *Calms* and *Tornadoes*.

2. Thoſe bound to the *Caribbe Iſles*, find, as they approach the *American* Side, that the aforeſaid N. E. Wind becomes ſtill more and more Eaſterly, ſo as ſometimes to be E. ſometimes E. b. S. but yet moſt commonly to the Northward of the Eaſt; a Point or two, ſeldom more. 'Tis likewiſe obſerved, that the Strength of theſe Winds does gradually decreaſe, as you ſail to the Weſtwards.

3. That the *Limits* of the *Trade* and *Variable* Winds in this *Ocean*, are farther extended on the *American* Side, than the *African*: for whereas you meet not with this certain Wind till after you have paſſed the Latitude of 28° on this ſide; on the *American* Side it commonly holds to 30, 31, or 32° of Latitude; and this is verified likewiſe to the Southward of the *Equinoctial*, for near the *Cape of Good Hope*, the Limits of the *Trade Winds* are 3 or 4° nearer the Line than on the Coaſt of *Braſil*.

4. That from the Latitude of 4° North to the aforeſaid Limits on the South-ſide of the *Æquator*, the Winds are generally and perpetually between the South and Eaſt, and moſt commonly between the South Eaſt and Eaſt, obſerving always this Rule, that on the *African* Side, they are more ſoutherly, on the *Braſilian* more eaſterly, ſo as to become almoſt due Eaſt, the little Deflection they have being ſtill to the Southwards. In this Part of the *Ocean* it has been my fortune to paſs a full Year, in an Employment that obliged me to regard more than ordinary the Weather, and I found the winds conſtantly about the South-Eaſt, the moſt uſual Point *S. E. b. E*; when it was Eaſterly it generally blew hard, and was gloomy, dark, and ſometimes rainy Weather; if it came to the Southwards, it was generally ſerene, and a ſmall Gale next to a Calm; but this not very common. But I never ſaw it to the weſtwards of the South, or Northwards of the Eaſt.

5. That the Seaſon of the Year has ſome ſmall Effect on theſe *Trade-winds*, for that when the Sun is conſiderably to the northwards of the *Æquator*, the South-eaſt Winds, eſpecially the Streight of this Ocean, (if I may ſo call it) between *Braſil* and the Coaſt of *Guinea*, do vary a Point or two to the Southwards, and the North-eaſt become more Eaſterly; and on the contrary, when the Sun is towards the *Tropick* of *Capricorn*, the South Eaſterly Winds become more Eaſterly, and the North Eaſterly Winds on this Side the Line were more to the Northward.

6. There is in this *Ocean* a Tract of Sea, wherein the Southerly and South-weſt-winds are perpetual, *viz.* all along the Coaſt of *Guinea*, for above 500 Leagues together, from *Sierra Leona* to the Iſle of St. *Thomas*, for the South-Eaſt *Trade-wind* having paſſed the *Line*, and approaching the Coaſt of *Guinea*, within 80 or 100 Leagues inclines towards the Shore, and becomes *S. S. E.* and by Degrees, as you come nearer, it veers about to South, *S. S. W.* and in with the Land *South-weſt*, and ſometimes *W. S. W.* which Variation is better expreſſed in the Map than it can well be in Words. Fig. 20. Theſe are the Winds which are obſerved on this Coaſt when it blows true, but there are frequent Calms, violent ſudden Guſts called *Tornado's*, from all Points of the

Compaſs, and ſometimes unwholſom foggy eaſterly winds, called *Hermitan*, by the Natives, which too often infeſt the Navigation of theſe Parts.

7. That to the Northwards of the Line, between 4 and 10 *deg.* of *Latitude*, and between the Meridians of *Cape Verde*, and of the Eaſtermoſt Iſlands that bear that Name, there is a Tract of Sea, wherein it were improper to ſay there is any *Trade Wind*, or yet a *Variable*, for it ſeems condemned to perpetual Calms, attended with terrible Thunder and Lightning, and Rains ſo frequent, that our Navigators from thence call this Part of the Sea the *Rains*: the little Winds that are, be only ſome ſudden uncertain Guſts, of very little Continuance and leſs Extent; ſo that ſometimes each Hour you ſhall have a different Gale, which dies away into a Calm before another ſucceed; and in a Fleet of Ships in Sight of one another, each ſhall have the Wind from a ſeveral Point of the Compaſs; with theſe weak *Breezes*, Ships are obliged to make the beſt of their way to the Southward thro' the aforeſaid ſix *Degrees*, wherein 'tis reported ſome have been detained whole Months for want of Wind.

From the three laſt Obſervables is ſhewn the Reaſon of 2 notable Occurrents in the *Eaſt-India* and *Guinea* Navigations. The one is, why notwithſtanding the narroweſt part of the Sea between *Guinea* and *Braſil* be about 500 Leagues over, yet Ships bound to the Southward, ſometimes, eſpecially in the Months of *July* and *Auguſt*, find a great difficulty to paſs it. This happens becauſe of the South-eaſt Winds, at that time of the Year commonly extending ſome *deg.* beyond the ordinary Limit of 4 *deg.* North *Lat.* and withal they come ſo much ſoutherly, as to be ſometimes South, ſometimes a Point or two to the Weſt; there remains then only to plie to windward, and if on the one ſide they ſtand away *W.S.W.* they gain the Wind ſtill more and more eaſterly, but there is Danger of not weathering the *Braſilian* Shore, or at leaſt the Shoals upon that Coaſt. But if upon the other Tack they go away *E.S.E.* they fall into the Neighbourhood of the Coaſt of *Guinea*, from which there is no departing without running eaſterly, as far as the Iſle of St. *Thomas*, which is the conſtant Practice of all the *Guinea* Ships, and which may ſeem very ſtrange, without the Conſideration of the 6*th* Remark, which ſhews the Reaſon of it. For being in with the Coaſt, the Wind blows generally at *S.W.* and *W.S.W.* with which winds they cannot go to the Northward for the Land, and on the other Tack, they can lie no nearer the Wind than *S.S.E.* or *S.* and with theſe Courſes they run off the Shore, but in ſo doing, they always find the Winds more and more contrary; ſo that when near the ſhore, they could lie ſouth, at a greater diſtance they can make their way no better than *S.E.* and afterwards *E.S.E.* with which Courſes they fetch commonly the Iſle of St. *Thomas* and Cape *Lopez*, where finding the Winds to the Eaſtward of the South, they keep them favourable by running away to the weſt-ward in the South *Lat.* of 3 or 4 *Deg.* where the *S.E.* Winds are perpetual.

For the ſake of theſe general Winds, all thoſe that uſe the *Weſt-Indian* Trade, even thoſe bound to *Virginia*, count it their beſt Courſe to get aſſoon as they can to the Southwards, that ſo they may be certain of a fair and freſh Gale, to run before it to the Weſtwards; and for the ſame reaſon thoſe homewards bound from *America*, endeavour to gain the Latitude of 30 *deg.* aſſoon as poſſible, where they firſt find the Winds begin to be Variable; tho' the moſt ordinary Winds in the Northern Part of the *Atlantick Ocean* come from between the South and Weſt.

As to thoſe furious Storms called *Hurricanes* which are as it were peculiar to the *Caribbe Iſles*; and which ſo dreadfully afflict them in the Month of *Auguſt*, or not much before or after, they do not ſo properly belong to this Place, both by Reaſon of their ſmall Continuance and Extent, as likewiſe becauſe they are not Anniverſary; ſome Years having more than one, and ſometimes for ſeveral Years together there being none at all. But their Violence is ſo inconceivable, and their other *Phænomena* ſo ſurpriſing, that they merit well to be conſidered apart.

What is here ſaid, is to be underſtood of the Sea-Winds, at ſome diſtance from the Land; for upon and near the ſhores, the Land and Sea Breezes are almoſt every where ſenſible; and the great Variety which happens in their Periods, Force and Direction, from the Situation of the Mountains, Vallies and Woods, and from the various Texture of the Soil, more or leſs capable of retaining and reflecting Heat, and of exhaling or condenſing Vapours, is ſuch, that it were an endleſs Task to endeavour to account for them.

2 In the *Indian* Ocean, the Winds are partly general, as in the *Æthiopick* Ocean, partly periodical, that is, half the Year they blow one way, and the other half near upon the oppoſite Points; and theſe Points and Times of ſhifting are different in different Parts of this Ocean.

1. Between the Latitudes of 10 *deg.* and 30 *deg.* South, between *Madagaſcar* and *Hollandia Nova*, the *General Trade-Winds* about the *S. E. b. E.* is found to blow all the Year long, to all Intents and Purpoſes after the ſame Manner as in the ſame Latitudes in the *Æthiopick Ocean*, as it is deſcribed in the 4*th* Remark aforegoing.

2. That the aforeſaid *S. E* Winds do extend to within 2 *deg* of the *Æquator* during the Months of *June*, *July*, and *Auguſt*, &c. to *November*, at which time between the South Latitudes of 2 and 10 *Deg.* being near the Meridian of the North End of *Madagaſcar*; and between 2 and 12 South Latitude, being near *Sumatra* and *Java*; the contrary Winds from the *N. W.* or between the North and Weſt, ſet in and blow for half the Year, *viz.* from the Beginning of *December* till *May*: and this *Monſoon* is obſerved as far as the *Molucca Iſles*, of which more anon.

3. That to the Northward of 3 *Deg.* South Latitude, over the whole *Arabian* or *Indian Sea* and *Gulf* of *Bengal*, from *Sumatra* to the Coaſt of *Africa*; there is another *Monſoon*, blowing from *October* to *April*, upon the *N. E.* Points; but in the other half Year, from *April* to *October*, upon the oppoſite Points of *S. W.* and *W. S. W.* and that with rather more Force than the other, accompanied with dark, rainy Weather, whereas the *N. E.* blows clear. 'Tis likewiſe to be noted, that the Winds are not ſo conſtant, either in Strength or Point, in the *Gulf* of *Bengal*, as they are in the *Indian* Sea,

where a certain ſteady Gale ſcarce ever fails. 'Tis alſo remarkable, that the *S. W.* Winds in theſe Seas are generally more Southerly on the *African* ſide, more Weſterly on the *Indian*.

4. There is a Tract of *Sea* to the Southwards of the *Æquator*, ſubject to the ſame changes of the Winds, *viz.* near the *African* Coaſt, between it and the Iſland *Madagaſcar* or St. *Lawrence*, and from thence Northwards as far as the *Line*; wherein from *April* to *October* there is found a conſtant Freſh *S. S W.* Wind, which as you go more Northerly, becomes ſtill more and more Weſterly, ſo as to fall in with the *W. S. W.* Winds mentioned before in thoſe Months of the Year to be certain to the Northward of the *Æquator*: What Winds blow in thoſe Seas for the other half Year, I have not yet been able to obtain to my full ſatisfaction: The account which has been given me is only this, that the Winds are much Eaſterly hereabouts, and as often to the North of the true Eaſt as to the Southwards thereof.

5 That to the Eaſtward of *Sumatra* and *Malacca*, to the Northwards of the *Line*, and along the Coaſt of *Camboia* and *China*, the *Monſoons* blow North and South; that is to ſay, the *N. E.* Winds are much Northerly, and the *S. W.* much Southerly. This Conſtitution reaches to the Eaſtwards of the *Philippine* Iſles, and as far Northerly as *Japan*. The Northern *Monſoon* ſetting in, in theſe Seas, in *October* or *November*, and the Southern in *May*, blowing all the Summer Months. Here it is to be noted, that the Points of the Compaſs from whence the Winds come in theſe Parts of the World, are not ſo fixt as in thoſe lately deſcribed; for the Southerly will frequently paſs a Point or two to the Eaſtwards of the South, and the Northerly as much to the Weſtwards of the North, which ſeems occaſioned by the great quantity of Land which is interſperſed in theſe Seas.

6. That in the ſame *Meridians*, but to the Southwards of the *Æquator*, being that Tract lying between *Sumatra* and *Java* to the Weſt, and *New-Guinea* to the Eaſt, the ſame Northerly and Southerly *Monſoons* are obſerved; but with this difference, that the Inclination of the Northerly is towards the *N W.* and of the Southerly towards the *S. E.* but the *Plagæ Venti* are not more conſtant here than in the former, *viz. Variable* 5 or 6 Points: Beſides, the times of the change of theſe Winds are not the ſame as in the *Chineſe* Seas, but about a Month or 6 Weeks later.

7. That theſe contrary Winds do not ſhift all at once, but in ſome places the time of the Change is attended with *Calms*, in others with *Variable* Winds; and it is particularly remarkable, that the End of the Weſterly *Monſoon* on the Coaſt of *Coromandel*, and the two laſt Months of the Southerly *Monſoon* in the Seas of *China*, are very ſubject to be *Tempeſtuous*: The Violence of theſe Storms is ſuch, that they ſeem to be of the Nature of the *Weſt-India Hurricanes*, and render the Navigation of theſe Parts very unſafe about that time of the Year. Theſe *Tempeſts* are by our Seamen uſually termed, the *Breaking up of the Monſoons*.

By reaſon of the ſhifting of theſe Winds, all thoſe that Sail in theſe Seas, are obliged to obſerve the Seaſons proper for their Voyages, and ſo doing they fail not of a Fair Wind and ſpeedy Paſſage; but if ſo be they chance to out-ſtay their time, till the contrary *Monſoon* ſet in, as it fre-

quently

quently happens, they are forced to give over the hopes of accompliſhing their intended Voyages, and either return to the Port from whence they came, or elſe put into ſome other Harbour, there to ſpend the time till the Winds ſhall come favourable.

3. That Navigation that there is on the *Mare Pacificum* is by the *Spaniards*, who go yearly from the Coaſt of *New-Spain* to the *Manilha*'s: But that is but by one beaten Tract; ſo that I cannot be ſo particular here as in the other two. What the *Spaniſh* Authors ſay of the Winds they find in their Courſes, and what is confirmed by the old accounts of *Drake* and *Candiſh*, and ſince by *Schooten*, who Sailed the whole breadth of this Sea in the Southern *Latitude* of 15 or 16 *deg.* is, that there is a great Conformity betwixt the Winds of this Sea, and thoſe of the *Atlantick* and *Æthiopick*; that is to ſay, that to the Northwards of the *Æquator*, the predominant Wind is between the *E.* and *N. E* and to the Southwards thereof, there is a conſtant ſteady Gale between the *E.* and *S. E.* and that on both ſides the *Line*, with ſo much Conſtancy that they ſcarce ever need to attend the Sails, and Strength; that it is rare to fail of Croſſing this vaſt *Ocean* in ten Weeks time, which is about 130 Miles *per diem*: Beſides, 'tis ſaid that Storms and Tempeſts are never known in theſe Parts; Wherefore ſome have thought it might be as ſhort a Voyage to *Japan* and *China*, to go by the *Streights* of *Magellan* as by the *Cape* of *Good Hope*.

The Limits of theſe *General* Winds are alſo much the ſame as in the *Atlantick* Sea, *viz.* about the 30*th.* degree of *Latitude* on both ſides; for the *Spaniards* Homewards bound from the *Manilha*'s, always take the advantage of the Southerly *Monſoon*, blowing there in the Summer Months, and run up to the Northwards of that *Latitude*, as high as *Japan*, before they meet with *Variable* Winds, to ſhape their Courſe to the Eaſtwards. And *Schooten* and others, that have gone about by the *Magellan Streights*, have found the Limits of *S. E.* Winds, much about the ſame *Latitude* to the Southwards; beſides, a farther Analogy between the Winds of this *Ocean* and the *Æthiopick* appears in that, that upon the Coaſt of *Peru* they are always much Southerly, like as they are found near the ſhores of *Angola*.

To help the Conception of the Reader in a matter of ſo ſuch difficulcy, *Fig.* 20. I believed it neceſſary to adjoyn a *Scheme*, ſhewing at one view all the various *Tracts* and *Courſes* of theſe Winds. The *Limits* of theſe ſeveral *Tracts* are deſigned every where by prickt Lines, as well in the *Atlantick* and *Æthiopick*, where they are the Boundaries of the *Trade* and *Variable* Winds, in the *Indian Ocean*, where they alſo ſhew the extent of the ſeveral *Monſoons*. The Courſe of the Winds is expreſt by Rows of ſtroaks in the ſame Line that a Ship would move, going always before it; the ſharp End of each little ſtroak pointing out that part of the *Horizon*, from whence the Wind continually comes; and where there are *Monſoons*, the Rows of the ſtroaks run alternately backwards and forwards, by which means they are thicker there than elſe-where. As to the great *South-Sea*, conſidering its vaſt extent, and the little Variety there is in its Winds, and the great Analogy between them, and thoſe of the *Atlantick* and *Æthiopick-Oceans*; beſides that the greateſt part thereof is wholly unkown to us; I thought it unneceſſary to lengthen the *Map* therewith.

In the foregoing Hiſtory are contained ſeveral Problems, that Merit well the Conſideration of our acuteſt Naturaliſts, both by reaſon of the conſtancy of the effect, and of the immenſe extent thereof; near half the Surface of the Globe being concerned; wherein if I am not able to account for all particulars, yet 'tis hoped the thoughts I have ſpent thereon, will not be judged wholly loſt by the Curious in Natural Inquiries.

1. *Wind* is moſt properly defined to be the Stream or Current of the Air; and where ſuch Current is Perpetual and Fixt in its Courſe, 'tis neceſſary that it proceed from a Permanent unintermitting Cauſe, capable of producing a like Conſtant Effect, and agreeable to the known properties of the Elements of *Air* and *Water*, and the Laws of the Motion of fluid Bodies. Such an one is, I conceive, the Action of the Sun's Beams upon the *Air* and *Water* as he paſſes every Day over the *Oceans*, conſidered together with the Nature of the Soil and Situation of the adjoyning *Continents*. I ſay therefore, *Firſt*, That according to the Laws of *Staticks*, the Air which is leſs Rarified or expanded by Heat, and conſequently more Ponderous, muſt have a Motion towards thoſe parts thereof which are more Rarified, and leſs Ponderous, to bring it to an *Æquilibrium*; and, *Secondly*, That the preſence of the Sun continually ſhifting to the Weſtwards; that part towards which the Air tends, by reaſon of the Rarefaction made by his greateſt Meridian Heat, is with him carried Weſtward, and conſequently the tendency of the whole Body of the lower Air is that way. Thus a *General* Eaſterly Wind is formed, which being impreſſed upon all the Air of a vaſt Ocean, the parts impel one the other, and ſo keep moving till the next return of the Sun, whereby ſo much of the Motion as was loſt, is again reſtor'd, and thus the Eaſterly Wind is made *Perpetual*.

2. From the ſame Principle it follows, that this Eaſterly Wind ſhould on the North ſide of the *Æquator*, be to the Northwards of the Eaſt, and in South *Latitudes* to the South thereof; for near the *Line*, the Air is much more Rarified, than at a greater diſtance from it; becauſe of the Sun's being twice in a Year vertical, and at no time diſtant above 23 *deg.* and a half, at which diſtance the Heat, being as the Sine of the Angle of Incidence, is but little ſhort of that of the Perpendicular Ray. Whereas under the *Tropicks*, though the Sun ſtay long Vertical, yet he is as long 47 *deg.* off; which is a kind of Winter, wherein the Air ſo Cools, as that the Summer Heat cannot warm it to the ſame degree with that under the *Æquator*, wherefore the Air to the Northwards and Southwards, being leſs rarified than that in the Middle, it follows, that from both ſides it ought to tend towards the *Æquator*. This Motion compounded with the former Eaſterly Wind, Anſwers all the *Phænomena* of the General *Trade-Winds*; which if the whole Surface of the Globe were Sea, would undoubtedly blow all round the World, as they are found to do in the *Atlantick* and *Æthiopick Oceans*.

3. But ſeeing that ſo great *Continents* do interpoſe and break the Continuity of the *Ocean*, regard muſt be had to the Nature of the Soil and the Poſition of the High Mountains, which I ſuppoſe the two Principal Cauſes

of the ſeveral *Variations* of the *Winds*, from the former General Rule: For if a Country lying near the Sun prove to be Flat, Sandy, low Land, ſuch as the *Deſerts* of *Libya* are uſually reported to be, the Heat occaſioned by the Reflection of the Sun's Beams, and the Retention thereof in the Sand, is incredible to thoſe that have not felt it; whereby the Air being exceedingly rarified, it is neceſſary that the Cooler and more Denſe Air ſhould run thitherwards to reſtore the *Æquilibrium*. This I take to be the Cauſe, why near the Coaſt of *Guinea* the Wind always ſets in upon the Land, blowing weſterly inſtead of eaſterly, there being ſufficient reaſon to believe, that the Inland Parts of *Africa* are prodigiouſly Hot, ſince the Northan Borders thereof were ſo Intemperate, as to give the Antients Cauſe to conclude, that all beyond the *Tropick* was made *Uninhabitable* by exceſs of Heat. From the ſame cauſe it happens, that there are ſo conſtant *Calms* in that parr of the Ocean, called the *Rains*, (deſcribed in the 7th Remark on the *Atlantick Sea*:) For this Tract being placed in the middle, between the weſterly Winds blowing on the Coaſt of *Guinea*, and the eaſterly *Trade Winds* blowing to the Weſtwards thereof, the tendency of the Air here, is indifferent to either, and ſo ſtands in *Æquilibrio* between both; and the weight of the incumbent *Atmoſphere* being diminiſhed by the continual contrary Winds blowing from hence, is the reaſon that the Air here holds not the copious Vapour it receives, but lets it fall into ſo frequent *Rains*.

4. But as the Cool and Denſe Air, by reaſon of its greater Gravity, preſſes upon the hot and rarified, 'tis demonſtrative that this latter muſt Aſcend in a continual ſtream as faſt as it Rarifies, and that being aſcended it muſt diſperſe it ſelf to preſerve the *Æquilibrium*, that is, by a *contrary Current*, the upper Air muſt move from thoſe parts where the greateſt Heat is: So by a kind of Circulation, the *N. E. Trade Wind* below, will be attended with a *S. W.* above, and the *S. E.* with a *N. W.* Wind above. And that this is more than a bare conjecture, the almoſt inſtantaneous Change of the Wind to the oppoſite Point, which is frequently found in paſſing the Limits of the *Trade Winds*, ſeems to aſſure us; but that which above al confirms this *Hypotheſis* is the *Phænomenon* of the *Monſoons*, by this mean moſt eaſily ſolved, and without it hardly explicable. Suppoſing therefore ſuch a Circulation as above, 'tis to be conſidered that to the Northward of the *Indian Ocean* there is every where Land within the uſua Limits of the *Latitude* of 30. *viz. Arabia*, *Perſia*, *India*, &c. which for th ſame reaſon as the Mediterranean Parts of *Africa* are ſubject to Unſufferable Heats when the Sun is to the North, paſſing nearly Vertical but yet are Temperate enough when the Sun is removed towards th other *Tropick*; becauſe of a Ridge of Mountains at ſome diſtance within the Land, ſaid to be frequently in Winter covered with Snow, ove which the Air, as it paſſes, muſt needs be much chilled. Hence it come to paſs, that the Air coming, according to the General Rule, out of th *N. E.* in the *Indian* Seas, is ſometimes hotter ſom times colder than tha which by this Circulation is returned out of the *S. W.* and by conſequenc ſometimes the under Current or Wind is from the *N. E.* ſometimes fro

no other Cauſe, is clear from the Times wherein theſe Winds ſet in, *viz.* in *April*, when the Sun begins to warm thoſe Countries to the North, the *S. W. Monſoon* begins, and blows during the Heats till *October*, when the Sun being retired, and all things growing cooler Northward, and the Heat increaſing to the South, the *N. E.* Winds enter and blow all the Winter till *April* again.

5. And it is undoubtedly from the ſame Principle that to the ſouthwards of the *Æquator*, in part of the *Indian Ocean*, the *N. W.* Wind ſucceeds the *S. E.* when the Sun draws near the *Tropick* of *Capricorn.* But I muſt confeſs, that in this latter occurs a Difficulty not well to be accounted for, which is, why this Change of the *Monſoons* ſhould be any more in this *Ocean*, than in the ſame *Latitudes* in the *Æthiopick*, where there is nothing more certain than a *S. E.* Wind all the Year.

6. 'Tis likewiſe very hard to conceive, why the Limits of the *Trade-wind* ſhould be fixt about the 30th *Deg.* of *Latitude* all round the Globe; and that they ſhould ſo ſeldom tranſgreſs or fall ſhort of thoſe Bounds, as alſo that in the *Indian* Sea, only the Northern Part ſhould be ſubject to the changeable *Monſoons*, and in the Southern there be a conſtant *S. E.*

Theſe are Particulars that merit to be conſidered more at large, and furniſh a ſufficient Subject for a juſt Volume.

Obſervations upon May-Dew, *by* Mr Tho. Henſhaw; n. 3, p. 33.

XXXVII. Mr. *Henſhaw* has obſerved, That *Dew* newly gathered, and filtred through a clean Linen Cloth, tho' it be not very clear, is of a yellowiſh Colour, ſomewhat approaching to that of Urine.

That having endeavour'd to purify it, by putting ſeveral Proportions into glaſs Bodies with blind Heads, and ſetting them in ſeveral Heats, as of Dung, and gentle Baths, he quite failed of his Intention: for Heat, tho' never ſo gentle, did rather clarify and preſerve it ſweet, tho' continued for two Months together; than cauſe any Putrefaction or Separation of Parts.

That expoſing of it to the Sun for a whole Summer in Glaſſes, that hold about 2 Gallons, with narrow Mouths that might be ſtopped with Cork, the only conſiderable Alteration he obſerved to be produced in it was, that ſtore of green Stuff (ſuch as is ſeen in Summer in Ditches and ſtanding Waters) floated on the Top, and in ſome places grew to the Sides of the Glaſs.

That putting 4 or 5 Gallons of it into a half Tub, as they call it, of Wood, and ſtraining a Canvaſs over it to keep out Duſt and Inſects, and letting it ſtand in ſome ſhady Room for 3 Weeks or a Month, it did of it ſelf putrify and ſtink exceedingly, and let fall to the Bottom a black Sediment like Mudd.

That coming often to ſee what Alterations appeared in the Putrefaction, he obſerved, that at the Beginning, within 24 Hours, a ſlimy Film floated on the Top of the Water, which after a while falling to the Bottom, there came another ſuch Film in its Place.

That if *Dew* were put into a long narrow Veſſel of Glaſs, ſuch as formerly were uſed for *Receivers* in diſtilling of *Aqua Fortis*, the ſlime would riſe to that Height, that he could take it off with a Spoon; and when he had put a pretty Quantity of it into a Drinking-glaſs, and that it had ſtood all Night and the Water drained from it, if he had turned it out on his Hand, it would ſtand upright in Figure of the Glaſs, in ſubſtance like boiled white Starch, tho' ſomewhat more tranſparent, if his Memory, *ſaith he*, fail him not.

That having once gotten a pretty Quantity of this Gelly, and put it into a Glaſs-Body and Blind-head, he ſet it into a gentle Bath, with an Intention to have putrified it, but after a few Days, he found the Head had not been well luted on, and that ſome Moiſture exhaling the Gelly was grown almoſt dry, and a large *Muſhroom* was grown out of it within the Glaſs; it was of a looſe watriſh Contexture, ſuch an one as he had ſeen growing out of rotten Wood.

That having ſeveral Tubs with good Quantity of *Dew* in them, ſet to putrify in the Manner aboveſaid, and coming to pour out of one of them to make uſe of it, he found in the Water a great Bunch bigger than his Fiſt, of thoſe Inſects commonly called *Hog-lice*, or *Millepedes*, tangled together by their long Tails, one of which came out of every one of their Bodies about the Bigneſs of a Horſe Hair. The Inſects did all live and move after they were taken out.

That emptying another Tub whereon the Sun it ſeems had uſed ſometimes to ſhine, and finding upon the ſtraining it thro' a clean Linen Cloth two or three Spoonfuls of green Stuff, though not ſo thick nor ſo green as that above mentioned, found in the Glaſſes purpoſely expoſed to the Sun, he put this green Stuff in a Glaſs, and tied a Paper over it, and coming ſome Days after to view it, he found the Glaſs almoſt filled with an innumerable Company of ſmall Flies, almoſt all Wings, ſuch as are uſually ſeen in great Swarms in the Air in Summer Evenings.

That ſetting about a Gallon of this *Dew*, (which, he ſaith, if he miſremember not, had been firſt putrified and ſtrained) in an open jarre Glaſs with a wide Mouth, and leaving it for many Weeks ſtanding in a South-window on which the Sun lay very much, but the Caſements were kept cloſe ſhut; after ſome time, coming to take Account of his *Dew*, he found it very full of little *Inſects*, with great Heads and ſmall tapering Bodies, ſomewhat reſembling *Tadpoles*, but very much leſs. Theſe on his Approach to the Glaſs, would ſink down to the Bottom, as it were to hide themſelves, and upon his Retreat, wriggle themſelves up to the Top of the Water again. Leaving it thus for ſome time longer, he afterwards found the Room very full of *Gnats*, tho' the Door and Windows were kept ſhut. He adds, that he did not at firſt ſuſpect that thoſe *Gnats* had any Relation to the *Dew*, but after finding the *Gnats* to be multiplied, and the little watry Animals to be much leſſened in quantity, and finding great numbers of their empty skins floating on the Face of his *Dew*, he thought he had juſt Reaſon to perſwade himſelf that the *Gnats* were by a ſecond Birth produced of thoſe little Animals.

That vapouring away great quantities of his putrified Dew in glaſs baſons and other earthen glaſed Veſſels, he did at laſt obtain, as he remembers, above 2 Pound of grayiſh Earth, which when he had waſhed with more of the ſame Dew out of all his Baſons into one, and vapoured to Siccity, lay in

Leaves one above another, not unlike to ſome kind of brown Paper, but very friable.

That taking this Earth out, and after he had well ground it on a Marble, and given it a ſmart Fire in a coated Retort of Glaſs, it ſoon melted and became a Cake in the bottom when it was cold, and looked as if it had been Salt and Brimſtone in a certain Proportion melted together; but, as he remembers, was not at all *inflamable.* This ground again on a Marble, he ſaith, did turn Spring Water of a reddiſh purple Colour.

That by often calcining and filtring this earth, he did at laſt extract 2 *Ounces* of a fine ſmall white *Salt*, which looked on thro' a good *Microſcope*, ſeem'd to have Sides and Angles in the ſame Number and Figure, as *Rock-Petre.*

XXXVIII. 1. We had of late, in the County of *Limerick* and *Tipperary*, Showers of a ſort of Matter like Butter or Greaſe; if one rub it upon one's Hand it will melt, but lay it by the Fire and it dries and grows hard, having a very ſtinking Smell. Some of it fell here at *Kilkenny*, *Nov.* 14, 1695. which I did ſee my ſelf the next Morning.

A kind of Dew *like Butter, in* Ireland; *by* Mr. R. Vans. n. 220. p. 223.

2. Having very diligently enquired concerning a very odd Phænomenon, which was obſerved in many parts of *Munſter* and *Leinſter*, the beſt account I can collect thereof, is as follows; For a good Part of the Winter 1695, and *Spring* following, there fell in ſeveral Places a kind of thick Dew. which the Country People call'd *Butter*, from the Conſiſtency and Colour of it, being *ſoft*, clammy, and of a dark Yellow; it fell always in the Night, and chiefly in mooriſh low Grounds, on the Top of the Graſs, and often on the Thatch of Cabbins; 'twas ſeldom obſerv'd in the ſame Places twice, it commonly lay on the Earth for near a Fortnight without changing its Colour, but then dried and turned black, Cattle fed in the Fields where it lay indifferently as in other Fields It fell in Lumps, often as big as the End of ones Finger, very thin and ſcatteringly; it had a ſtrong ill ſcent, ſomewhat like the ſmell of Church yards or Graves; And indeed we had during moſt of that ſeaſon very ſtinking Fogs, ſome ſediment of which might poſſibly occaſion this ſtinking Dew tho' I will by no means pretend to offer that a Reaſon of it. I cannot find that it was kept long, or that it bred any *Worms* or *Inſects*: yet the ſuperſtitious Country People, who had ſcal'd or ſore Heads, rubb'd them with this ſubſtance, and ſaid it healed them.

By the Biſhop of Cloyne, *ib.*

XXXIX. *Dec.* 6, 1631, Being in the Gulf of *Volo*, riding at Anchor, about 10 of the Clock that Night, it began to rain Sand or Aſhes, and continued till two of the Clock the next Morning. It was about two Inches thick on the Deck; ſo that we caſt it over-board with ſhovels, as we did ſnow the Day before. There was no Wind ſtirring when theſe *Aſhes* fell; it did not fall [illegible] in the Places where we were, but likewiſe in other Parts, as ſhips were [illegible]ming from *St. John d' Acre* to our Port; they being at that Time 100 [illegible]gues from us. We compared the Aſhes together, and found them both [illegible]

A Shower of Aſhes, *in the* Archipelago, *by Capt.* Will. Badily, n. 21. p. 377.

N. B. This ſhower of Aſhes was upon an *Eruption* of Mount *Veſuvius.*

XL. This

A Shower of Ivy Berries, *miſtaken for* Wheat; *by* Mr W. Cole, n. 188. p. 281.

XL. This City of *Briſtol* and the Country round, is filled with reports of raining Wheat about *Warminſter* in *Wiltſhire*, and other Places within 6 or 8 Miles of it, and many believe it. I have procured ſeveral parcels of it, and find it to be the Seed of *Ivy Berries*, which from Towers and Churches Chimneys, Walls, and high Buildings were lately by very fierce Tempeſts of Wind and Hail driven away from the Holes Chinks, and other Parts, where Birds had brought them, eſpecially *Sterlings* and *Choughs*. It was (among many other prodigious Stories) confidently affirmed, that thoſe Grains were found in the Hail, as Seeds in Comfits. I have by all ways I can imagine, examined and compared them with the Seeds of *Ivy-Berries*, by the Taſte, Smell, Size, and Figure; with the Aſſiſtance of *Magnifying Glaſſes*, viewing them in both the ſuperficial and inward Parts.

A Shower of Fiſhes *in* Kent; *by Dr.* Rob. Cony, n. 243. p. 889.

XLI. On *Wedneſday* before *Eaſter*, *An.* 1696, a Paſture Field at *Cranſtead* near *VVrotham* in *Kent*, about two Acres which is far from any part of the Sea or Branch of it, and a Place where are no Fiſh-ponds, but a ſcarcity of water, was all over-ſpread with little Fiſhes conceived to be rained down, there having been at that time a great Tempeſt of Thunder and Rain. The Fiſhes were about the length of a Man's little Finger, and judged by all that ſaw them to be young Whitings, many of them were taken up and ſhewed to ſeveral Perſons. The Field belonged to one *Ware* a Yeomen, who ſhew'd ſome of them, among others, to Mr. *Lake* a *Bencher* of the *Middle-Temple*, who had one of them, and brought it to *London*. The Truth of it was averr'd by many that ſaw the Fiſhes lie ſcattered all over that Field, and none in the other Fields thereto adjoining. The Quantity of them was eſtimated to be about a Buſhel, being all together.

I had this Account from a worthy Gentleman of this Country, who had a Box full of the Fiſhes.

Hailſtones *of an extraordinary Bigneſs*; *by Dr.* Nath. Fairfax, n 26. p. 481.

XLII. *July* 17. 1666, About 10 in the Forenoon, there fell a violent ſtorm of *Hail* upon the Coaſt-Towns of *Suffolk*, tracing along *Seckford Hall*, *Woodbridge*, *Snapebridge*, *Aldborough*, &c. more to the Northwards. The *Hail* was ſmall near *Yarmouth*; but at *Seckford-Hall*, one *Hail-ſtone* was found by Meaſure to be 9 Inches about. One of this Town (*viz.* *Woodbridge*) found one at *Melton*, 8 Inches about. At *Snape-bridge* a Man affirmed, that he lighted on one about 12 Inches about. A Lady of *Friſton-Hall*, putting one of them into a Balance, found it weigh 12 *s.* and 6 *d.* Several Perſons of good Credit in *Aldborough* affirmed ſome *Hail-ſtones* to have been full as big as *Turkeys Eggs* (an ordinary *Hen*'s Egg weighs but about 9 *s.*) *J. Baker* of *Rumborough*, had his Head broken by the Knocks of them thro' a ſtiff Country Felt; in ſome places his Head bled, in others Bunneys aroſe: The Horſes were ſo pelted, that they hurried away his Cart beyond all Command. They ſeemed all white, ſmooth without, ſhining within. 'Tis 'ſomewha ſtrange, methinks, that their Pillar of Air ſhould keep them aloft, if the

wer

were not clapt together in the falling, eſpecially at ſuch a Time of the Year when the Air is leſs thickned, and its Springs weaker.

XLIII. In *May*, 1686, There fell at *Liſle* in *Flanders*, *Hail* of ſo great a Bigneſs, that the leaſt exceeded Pigeon's Eggs. Several of them were a Quarter of a Pound Weight and more. One among the reſt was obſerved to contain a dark brown Matter in the middle thereof, and being thrown into the Fire, it gave a very great Report. Others were tranſparent, which melted before the Fire immediately. This Storm paſſed over the Citadel and Town, and left not a whole Glaſs in the Windows on the windward ſide. The Treet were broken, and ſome beat down; and the *Partridges* and *Hares* kill'd in Abundance.

Large Hail-ſtones in Flanders, by ... n. 203. p. 858.

XLIV. 1. A very extraordinary Hail fell in theſe Parts *Apr.* 29, 1697. The Vapour that diſpoſed the aqueous Parts thus to congeal came with a South-weſt-wind out of *Carnarvanſhire*, paſſing near *Snowdon* with a horrid black Cloud attended with frequent *Lightnings* and *Thunder*. As yet I hear no further of it weſtward than out of *Denbighſhire*, where it left St. *Aſaph* to the Right, and did much damage between it and the Sea, breaking all the Windows on the Weather-ſide, and killing Poultry and Lambs, and at Sir *John Conway*'s at *Deſert*, a ſtout Dog; and in the North part of *Flintſhire* ſeveral People had their Heads broke, and were grievouſly bruiſed on their Bodies. From *Flintſhire* it croſſed over the Arm of the Sea that comes up to *Cheſter*, and was only felt in *Cheſhire*, at the very N. W. Corner of the *Peninſula* call'd *Wiral*, between the *Æſtuaria* of *Cheſter* and *Leverpoole*, at a Town call'd *W. Kirby*, where it hailed but for 3 Minutes, it being on the extream Point thereof, on the Right-hand, but it thundred dreadfully, and was here at *Cheſter* about 3 in the Afternoon; but the main Body of it fell upon *Lancaſhire*, in a right Line from *Ormskirk* to *Blackborn*, which is on the Borders of *Yorkſhire*; but whether it croſſed the Ridge of Hills into *Yorkſhire*, we know not. The Breadth of the Cloud was about 2 Miles; within which Compaſs it did incredible damage, killing all ſorts of Fowl and ſmall Creatures; and ſcarce leaving any whole Panes in any of the windows where it paſſed; but which is worſe, it plowed up the Earth, and cut off the Blade of the green Corn ſo as utterly to deſtroy it, the *Hail-ſtones* burying themſelves in the Ground; and the Bowling Greens, where the Earth was any thing ſoft, were quite defaced, ſo as to be rendred unſerviceable for a Time. This I had from an Eye witneſs. The *Hail-ſtones* ſome of which weighed 5 *Ounces*, were of differing Forms, ſome round, ſome half round, ſome ſmooth, others emboſſed and crenulated, like the Foot of a drinking Glaſs, the Ice very tranſparent and hard, but a *ſnowy Kernel* was in the midſt of moſt of them, if not all; the force of their Fall argued them to fall from a great Height. What I take to be moſt extraordinary in this *Phænomenon* is, that ſuch a ſort of Vapours ſhould continue undiſperſt for ſo long a Tract, as is above 60 Miles together, and in all the way of its paſſage occaſion ſo extraor-

Extraordinary Hail in Wales, Cheſhire &c. by Mr. Edm. Halley, n. 229. p. 570.

dinary a *Coagulation* and *Congelation* of the watry Clouds, as to encreaſe the *Hail-ſtones* to ſo vaſt a Bulk in ſo ſhort a ſpace as that of their Fall;

By .... ib. p. 572. 2. We had only the extream Skirt of the Shower here, and there fell not above 10 *Hailſtones* in our Court, but they were much larger and harder than the oldeſt of us had ſeen. A Gentlewoman found one of them by Meaſure to be about 5 Inches about. A little while after the Shower was over, I found the *Stones* had fallen at good diſtances one from another, and that they were melting very faſt, the Weather being very hot; ſcarce any of them was ſo little as a Muſquet Bullet, but moſt of them far bigger, and of that Figure.

A Servant who was then at *Bootle-Mill*, tells me, That the Sea ſeemed to be riſen to an unwonted height, and to bear the Appearance of a Wood; That he found *Hail-ſtones* as big as *Poot Eggs*. And that many Sea-Fowl and Land-Fowl were killed: and as an Inſtance of it, he took up a *Sea-ſwallow* on *Bootle Marſh*, whoſe Wing was broken with an icy Pellet, and brought her home. Upon this ſtory, I rid towards the Grounds which had ſhared moſt in the *Storm*. When I came to *Bootle*, I ſaw *Jane Mutche*'s Windows ill batter'd; I found the Storm had been as violent at *Linaker*, I ſaw what Breaches it had made upon *Will. Halſal*'s Barns, what Boughs it had broke off from his Appletrees and what Wounds the *Hail-ſtones* had made in the green Brow by his Houſe. I meaſured ſeveral of the Holes, and found them generally an Inch deep, and ſome an Inch and a half. *Will. Halſal* told me, that the great *Stones* fell ſo violently into the Marl-pit beſides his Houſe, that ſpouts of Water roſe a Yard and a half high. This unriddled my Man's Story, that the Sea appeared like a Wood. Dr. *Tarleton* took up *Hail-ſtones* as big as *Duck Eggs* upon *Aughton Common*; and Mr. *Shepherd* profeſſes, that the Church-yard at *Sephton* ſeem'd as ſtrew'd with *Duck-Eggs*; and that one of them was weighed, which amounted to full half a Pound; two *Hailſtones* were weighed at *Ormskirk*, which came to ¼ of a Pound a piece. At *Ince* the *Stones* were part as big as *Duck* and part as *Gooſe-Eggs*.

I ſent ſome People the next Morning early to the Sea-ſide, and they brought in ſeven ſorts of Fowls, as *Curlieu*, *Sea Pye*, *Sea Swallow*, *Gorre*, and other we want Names for: and we hear that at the little Towns next the Sea, they were picked up by Buſhels.

No *Hail* fell at *Everton*, *Lowhill*, or *Leverpoole*, the Storm ending near *Walton*, but there was ſo thick a Darkneſs before the Storm, that in *Leverpoole*, many People ran out of their Houſes into the Street to look at the Face of the Sky; and it was marvellous dark here. The Neighbours tell doleful Stories of the Effects of this Hail; As a young Woman at *Bootle* was running for Shelter, her Hat fell off, and a *Hail-ſtone* that hit her behind the Ear, made her tumble; a Man was knockt off his Horſe by the *Hail*, but presently got up again; Another having pull'd down his Hat to ſave his Face, a *Stone* fell which tore the Brim from the Crown, ſo far that he could put his Hand thro' the Hole; at *Ormskirk* 4 Pounds Damage was done to one Inn, and the Glaſs broke by the Storm in the whole Town could not be repaired for 60 *l.* The Stones there rebounded, many of them 2 Yards high; at *Ince* two Horſes were knockt down in the Plough, and a Man fell at the ſame time; at *Crosby* ſome Beaſts were knock'd down; One *Jo. Holland* was found dead in *Skirmſdale* after the Shower, but whether by the *Hail* or *Lightning* (for it came with *Thunder* and *Lightning*) I have not yet heard; Two Women were ſo beaten by it, in a little while before they got Covert, that they could hardly turn them in their Beds next Morning; They could hardly paſs the Lanes for Baskets, Panniers, Sacks, and People, which the Horſes had thrown down in their Return from *Ormskirk* Market.

XLV. On *Tueſday*, *May* 4, 1697. (at *Hitchin* in *Hartfordſhire*) about 9 a Clock in the Morning, it began to lighten and thunder extreamly, ſome great Showers intervening; it continued till about two of the Clock in the Afternoon, when on a ſudden a black Cloud aroſe *S. W.* of us, the Wind being Eaſt, and blew hard, then fell a ſharp Shower, with ſome *Hail-ſtones*. I meaſured ſome of them 7 and 8 Inches about: but the Extremity of the Storm fell about *Offley*, where a young Fellow was kill'd, one of his Eyes ſtuck out of his Head, his Body was all over black with the Bruiſes; another Perſon nearer to *Offley* eſcaped with his Life, but much bruiſed; there was in the Houſe of Sir *Jo. Spencer*, 7000 Quarries of Glaſs broke, and there was great Damage done to all the neighbouring Houſes thereabouts; the Hail fell in ſuch vaſt Quantities, and ſo great, that it tore up the Ground, ſplit great Oaks and other Trees in great Numbers; it cut down great Fields of Rye, as with a Scythe, and has deſtroy'd ſeveral hundred Acres of Wheat, Barley, *&c.* in ſo much that they plough it up and ſow it with Oates. The *Tempeſt* was ſuch when it fell that in 4 Poles of Land, from the Hills near us, it carried away all the Staple of the Land, leaving nothing but Chalk; the *Hail* broke vaſt Numbers of Pigeons Wings, Crows, Rooks, and other Birds: the Flood came down, ſpreading 4 or 5 Acres of Land, rowling like the Bay of *Biſcay*; and which is very ſtrange, all this fell in the Compaſs of one *Engliſh* Mile. I was walking in my Garden, which is very ſmall, perhaps about 30 Yards ſquare, and before I could get out, it took me to my Knees, and was through my Houſe before I could get in, which I can modeſtly ſpeak was in the ſpace of a Minute, and went thro' all like a Sea, carrying all wooden things like Boats on the Water, the greateſt part of the Town being under this Misfortune; the Surprize was ſo great, that we had ſcarce time enough to ſave our Children and Wives. There fell ſome hundred thouſand Cart-loads: I ſaw them 4 days after, and if the Beds of *Hail* had not been broke by People's coming, and trampling of Horſes, it might have lain till *Michaelmas*. They have been meaſured from one to thirteen and fourteen Inches certain: Some People talk largely of it, ſeventeen and eighteen Inches; but the other is certain truth. The Figures of them are various, ſome oval, others round, others picked, ſome flat. We were not ſo curious to weigh them. The Damage about us, and in our Town, is near 4000*l.*

A Storm of Hail in Hertfordſhire, May 4, 1697. by Mr. Rob. Taylor, ib. p. 577.

XLVI. 1. In the Pariſh of *Weſtbide*, not far from *Hereford*, there fell on the 6 of *June*, 1697. ſo great a Quantity of *Hail*, that it deſtroyed all the Poultry, Garden-ſtuff, Corn, Graſs, and moſt of the Fruit-trees in the Pariſh, but

A Storm of Hail *in* Herefordſhire, June 6, 1697; by ... ib. 579.

but killed no Men nor Cattle; but hurt ſeveral, and broke moſt of the Windows. Many of the Stones were meaſured above 9 Inches in Compaſs.

By M. Edw. Lhwyd, ib.

2. We had at *Ponty Pool* in *Monmouthſhire*, *June* 6, 1697, an extraordinary Shower of *Hail*, which extended about a Mile, and laſted near half an hour. It broke the ſtalks of all the Beans and Wheat within that Circumference, and ruined as much Glaſs at Major *Hanbury*'s Houſe, as coſt 4 Pounds repairing; ſome of the *Hail* were 8 Inches about, their Figure very irregular and unconſtant, ſeveral of the *Hail-ſtones* being compounded.

An unuſual ſort of Snow; *By* Mr. Joh. Chr. Beckman, n. 39. p. 773.

XLVII. The firſt of *March* 166$\frac{7}{8}$, there fell an unuſual ſort of Snow at *Frankfort* in the *Oder*: It had none of the ordinary Figures, but was made up of little Pillars, whereof ſome were *Tetragonal*, ſome *Hexagonal*, with a neat *Baſis*. On the Top they were ſomewhat larger, as the *Heads of Columns* are. Conſidering the whole Shape, we thought fit to give it the Name of *Nix Columnaris*.

Red Snow *near* Genoa; *communicated by Sig.* Sarotti, n. 139. p. 976.

XLVIII. On St. *Joſeph*'s Day, upon the Mountains called *Le Langhe*, there fell upon the white Snow that was there already, a great Quantity of Red, or if you pleaſe, of bloody Snow; from which, (being ſqueezed) there came a Water of the ſame Colour.

Obſervations on Snow, *By* *Dr.* J Beale, n. 56. p. 1138

XLIX. I have ſeen the Water of diſſolved Snow perform a quick Cure, in taking out the Fire when the Fleſh was burn by a Warming-pan of Braſs, which Metal commonly makes the Burning more difficult to be cured: Which did put me in Mind to examine the Figures of the Snow which now fell in this extreme Froſt. I expected that we might ſee thro' the ſmall Particles at leaſt as thro' Lice, Fleas, Cheeſe-mites, *&c.* by ſome Kind of Tranſparence: But I was deceived; my Aſſiſtants could make nothing of it, either by an ordinary or extraordinary Microſcope.

The Nature of Snow, *By* *Dr.* Nehem. Grew, n. 92. p. 5193.

L. He that will enquire of the Nature of Snow, will do it beſt, not by the Purſuit of his Fancy in a Chair, but with his Eyes abroad; where if we uſe them well fixed, and with good caution, and this in a thin, calm and ſtill Snow, we may by Degrees obſerve,

1. With M. *Des Cartes*, and Mr. *Hook*, that many parts hereof are of a regular Figure, for the moſt Part, as it were, ſo many little Rowels, or Stars, of 6 Points, being perfect and tranſparent *Ice*, as any we ſee upon a Pool or Veſſel of Water. Upon each of theſe 6 Points are ſet other collateral Points, and thoſe always at the ſame Angles as are the main Points themſelves.

2. Amongſt theſe regular Figures, many others alike regular, but far leſs, may likewiſe be diſcovered.

3. Looking ſtill more warily we ſhall perceive, that there are divers others indeed irregular, yet chiefly but the broken Points, Parcels and Fragments of the regular ones.

Laſtly, That beſides the broken parts, there are ſome others which ſeem to have loſt their Regularity, not ſo much in being Broken, as by various Winds, firſt gently Thaw'd, and then Froze into little Irregular Clumpers again.

From whence the true Notion and External Nature of *Snow* ſeemeth to appear, *viz.* That not only ſome few parts of *Snow*, but Originally the whole Body of it, or of a *Snowy* Cloud, is an infinite Maſs of *Icicles* Regularly Figur'd; not one particle thereof, I ſay, Originally, not one of ſo many Millions, being Indeterminate or Irregular: That is to ſay, a Cloud of Vapours being gathered into Drops, the ſaid Drops forthwith deſcend; upon which Deſcent, meeting with a ſoft Freezing Wind, or at leaſt paſſing through a Colder Region of the Air, each Drop is immediately Froze into an *Icicle*, ſhooting it ſelf forth into ſeveral Points or *Striæ* on each hand from-ward its Center: But ſtill continuing their Deſcent, and meeting with ſome ſprinkling and intermixed Gales of Warmer Air, or in their continual Motion, and Waſtage to and fro touching upon each other, ſome are a little Thaw'd, Blunted, Froſted, Clumper'd, others Broken, but the moſt Hanked and clung in ſeveral parcels together, which we call *Flakes* of *Snow*.

Hence we underſtand why *Snow*, though it ſeems to be ſoft, yet 'tis truly Hard, becauſe true *Ice*; the inſeparable property whereof is, to be Hard; ſeeming only to be ſoft, becauſe upon the firſt touch of the Finger upon any of its ſharp Edges or Points, they inſtantly Thaw, or otherwiſe they would Pierce our Fingers as ſo many Lancets.

Why again, though it be true *Ice*, and ſo a hard and denſe Body, yet very Light; becauſe of the extream Thinneſs of each *Icicle* in compariſon of its breadth. For ſo Gold, which though of all Bodies the moſt ponderous, yet being beaten into Leaves, rides upon the leaſt breath of Air.

Alſo how it is White; becauſe conſiſtent of parts all of them ſingly Tranſparent, but being mixed together, appear White; as the parts of Froth, Glaſs, Ice, and other Tranſparent Bodies, whether ſoft or hard.

The *Eſſential Nature* of *Snow*, I think may be beſt underſtood, by comparing its general Figure with ſuch regular Figures as we ſee in divers other Bodies; in that where we ſee the like Configurations, we may believe there is the like *Subject* wherein, or the like *Efficient* whereby, both thoſe and theſe are made.

As for the *Figure* of *Snow*, 'tis generally one, *viz.* That which is above deſcribed: Rarely of Different ones, which may be reduced chiefly to two generals, Circulars and Hexagonals either Simple or Compounded together: More rarely, either to be ſeen of more than 6 Points, but if ſo, then not of 8 or 10, but 12: Or in ſingle Shoots, as ſo many ſhort ſlender Cylinders like thoſe of *Nitre*: Or by one of theſe Shoots, as the Axle-tree, and touching upon the Center of a Pair of pointed *Icicles*, joyned together as the two Wheels: Or the ſame Hexagonal Figure, and of the ſame uſual Breadth, but continued in thickneſs or profundity, like the Stone, which, as I remember, *Boetius* calls *Aſtroites*. All theſe I ſay are Rare, the firſt deſcribed being the general *Figure* [illegible]

As for the *Configurations* of other Bodies, we ſhall find, that there are divers which have ſome a leſs, others a more near reſemblance hereunto.

Nitre is formed, as is commonly known, into long Cylindrical Shoots, as alſo all *Lixivial Salts*, for the moſt part; reſembling, though not perfectly, the ſeveral Points of each Starry *Icicle* of *Snow*. *Salt* of *Harts Horn*, *Sal-Armoniac*, and ſome other *Volatile Salts*, beſides their Main and longer Shoots, have others ſhorter branched out from them; reſembling as thoſe the Main, ſo theſe the Collateral Points of Snow. But the *Icicles* of *Urine* are ſtill more near: For, in *Salt* of *Harts-Horn*, although the Collateral Shoots ſtand at Acute Angles with the Main, yet not by Pairs at equal height; and in *Sal-Armoniac*, although they ſtand Diametrically oppoſite, or at equal height, yet with all at right, not Acute Angles; whereas in the *Icicles* of *Urine* they ſtand at equal height, and at Acute Angles both: In both, like thoſe of *Snow*. And it is obſervable, that the *Configuration* of *Feathers* is likewiſe the ſame; the reaſon whereof is, becauſe Fowls having no Organs for the Evacuation of *Urine*, the *Urinous* Parts of their Blood are Evacuated by the Habit or Skin, where they produce and nouriſh *Feathers*.

From hence it ſhould ſeem, That every Drop of Rain aforeſaid, containing in it ſelf ſome *Spirituous* Particles (as from the height to which they are advanced, the Prolifique Virtue of *Rain*, and its eaſy tendency to Putrefaction above other Water, is argued they do,) and meeting with others in their Deſcent of a *Saline*, and that partly *Nitrous*, but chiefly *Urinous*, or of an *Acidoſalinous* Nature, the ſaid *Spirituous* Parts are apprehended by them, and with thoſe the Watry, and ſo the whole Drop is fixed; yet not into any indifferent and Irregular ſhape, depriving the *Spirituous* parts of their Motion in an inſtant; but according to the *Energy* of the *Spirituous* as the Pencil, and the ſpecifick Nature or determinate poſſibility of the *Saline* parts as the Ruler, 'tis thus figured into a little Star.

A Freezing Rain *in* Somerſetſhire; *by* Dr. J. Beal, n. 90. p. 5138.

LI. 1. The *Freezing Rain*, which fell here the 9th, 10th, or 11th, of *December* 1672, (for I cannot confine the time exactly) hath made ſuch a Deſtruction of Trees, in all the Villages and High-Ways from *Briſtol* towards *VVells*, and towards *Shepton-Mallet*, and towards *Bath* and *Bruton*, and in other places of the *VVeſt*, that both for the manner and matter it may ſeem incredible; and is more ſtrange than I have found in any *Engliſh* Chronicle. You have the Proof and manner and beſt Meaſure of it in the following Tranſcript. "The late Prodigious *Froſt*, (*ſaith a very worthy* "*Perſon of unqueſtionable Credit*) hath much diſabled many old Orchards, "expoſed to the North-eaſt; had it concluded with ſome Guſts of Wind, "it might have been of ſad importance; I weighed the Sprigg of an Aſh-"Tree of juſt three quarters of a pound, which was brought to my "Table; the *Ice* on it weighed 16 pounds, beſides what was melted off "by the Hands of them that brought it. A very ſmall Bent at the ſame "time was produced, which had an *Icicle*, encompaſſing it, of 5 Inches "round by meaſure. Yet all this while, when Trees and Hedges were "loaden with *Ice*, there was no *Ice* to be ſeen on our Rivers, not ſo much "as on our ſtanding Pools. The like, or worſe and more ſtrange com- [illegible] plaints, I received from ſeveral other places, and from Eye Witneſſes of Credit. Some Travellers were almoſt loſt by the Coldneſs of the *Freezing* Air, and *Freezing Rain.* All the Trees, Young and Old, on the Highway from *Briſtol* to *Shepton*, were ſo torn and thrown down on both ſides the Ways, that they were unpaſſible. By the like Obſtructions the Carriers of *Bruton* were forc'd to return back. Some were affrighted with the noiſe in the Air, till they diſcerned that it was the clatter of *Icy* Boughs, daſhed one againſt another by the Wind. Some told me that riding on the Snowy Downs, they ſaw this *Freezing Rain* fall upon the Snow, and immediately *Freeze* to *Ice*, without ſinking at all into the Snow; ſo that the Snow was covered with *Ice* all along, and had been dangerous, if the *Ice* had been ſtrong enough to bear them. Others were on their Journey when the *Ice* was able to bear them in ſome places, and they were in great diſtreſs.

Dec. 8. Much Snow fell here; the 9th much *Rain* fell here; and all the Snow paſſed away, not leaving an *Icicle* amongſt us. The 10th Day, we had ſuddain fits of Cold and relaxing Warmneſs. On *Wedneſday* (*Dec.* 11) I ſaw a Young Man, who returning home from a Journey of 5 Miles, and coming into a warm Room, cryed out of extream Torments in all part of his Body. He affirmed, that the Air, and the Winds (which were then ſomewhat high) were ſo unſufferably Cold, that he was in utter Deſpair of coming Home alive; yet all that Day nothing but moiſt Dew fell under our Feet. If we ſay, the Earth did ſend forth warn Steams to keep this *Freezing Rain* diſſolved on her Surface; whence ſhall we ſay, the Air, and Rain and Winds got theſe *Freezing Icicles*, which oppreſſed Men and Plants? When the Candied *Froſts* do cover our Fruit-Trees perfectly white (as I have oft-times ſeen it hold for ſome Weeks together) it is ſo far from doing hurt to the Trees, that we have it in a Proverb for a good Sign of abundance of Fruit, in the enſuing Year: But this *Freezing Rain*, as ſoon as it touched any Bough, ſettled into *Ice*, and by multiplying and enlarging the *Icicles* (eſpecially where it could lay hold on Moſs or other aſperities of the Tree) it broke all down with the Weight.

n. 116. p. 357. This ſhews that a *Froſt* may be very Fierce and Dangerous in the Air, and on the Tops of ſome Hills and Plains, whilſt in many other places it keeps at two, three, or four foot diſtance above the Ground, Rivers and Lakes; and many wander, at ſome difference of time, in ſome places very Furious; in other places intermediate and not far aſunder, very Remiſs, and abated; where it was Fierce always at the height of Trees at leaſt, never on the ground Vehement, that I could hear of, but on *Saliſbury Plains*, which are very high Grounds.

n. 90. p. 5140. As ſoon as theſe *Froſts* were over, we had *Glowing Heats*, which cauſed a general complaint amongſt us of exceſſive Sweating, by Night and Day. The Buſhes and many Flowers in the Garden appeared in ſuch forwardneſs, as if it were in *April* or *May* I ſaw young Coleworts growing; and not far from my abode, an Apple-Tree Bloſſomed before *Chriſtmas.* This I do not mention for extraordinary; but I think 'tis more than ordinary, that before *New-Years-Tide* this Apple-Tree bore Apples perfectly knitted, and as big as ones Fingers end.

2. The

At Oxford; By Dr. Wallis, n. 92. p. 5195 n. 231 p. 654.

2. The like ſtrange Froſt was with us at *Oxford.* It was rather a *Raining* of *Ice*, or at leaſt *Raining Freezing* as it fell; which made ſtrange *Icicles* hanging on Trees, and a ſtrange Noiſe by the rattling of them upon the Boughs motion by the Wind; but not ſo much as at the places you mention in *Somerſetſhire.* Yet more in the Country about us (as from ſeveral Relaters I have heard,) than with us here. And the great *Warmth* ſoon after was alſo with us; in ſo much that not only Bloſſoms, but (as was then certainly affirmed, though I was not ſo curious as to get a ſight of any,) green Apples were obſerved on divers Trees; particularly in the Pariſh of *Holywell.*

Effects of Cold *in the Northern Countries, By* M. J Scheſferus, n. 19. p. 350.

LII. 1. Mr. *John Scheſſerus*, a Profeſſor in the *Sweediſh Univerſity* at *Upſal*, writes, That he had ſeen and had *Hares*, which about the beginning of *Winter* and *Spring* were half *White* and half of their Native Colour: That in the midſt of *Winter* he never ſaw any but all *White.* That *Foxes* alſo are *White* in *Winter*, and *Squirrels* Grayiſh mixt of a *Dark* and *White* Colour.

That Fiſhes are killed by reaſon of the *Ice* not being broken: but firſt, in Ponds only or narrow Lakes, next, in ſuch Lakes only, where the *Ice* is pretty thick; for, where 'tis thin, they Die not ſo eaſily: Laſtly that thoſe Fiſhes that lie in Slimy or Clayie Ground Die not ſo ſoon as others.

That in great Lakes, when 'tis a very bitter *Froſt*, *Ice* is wont to be broken either by the Force of the Waves, or of the impriſoned Vapours, raiſed by the Agitation of the Water, and then burſting out with an Impetuoſity, witneſs the noiſe made by the Rupture of the *Ice* though the whole length of ſuch Lakes, which he affirms to be not leſs Terrible than if many Guns went off together. Whereby it falls out, that *Fiſhes* are ſeldom found dead in great Lakes.

That neither Oil, nor a ſtrong Brine of Bay-Salt, is truly congealed into *Ice*, in thoſe Parts: That the *Froſt* pierces into the Earth, two Cubits or *Swediſh Ells*, and what Moiſter is found in it, is white, like *Ice.* That Waters, if ſtanding, *Freeze* to a greater depth, even to three ſuch *Ells* or more; but thoſe that have a Current, leſs: That Rapid Waters *Freeze* not at all; nor ever Bubbling Springs; and that theſe latter ſeem even to be Warmer in Winter, than Summer.

By M. Fehre, *ibid.* 351.

2. M. *Febre*, Chief Secretary to Prince *Radzivil*, aſſures us, that in the War againſt the *Muſcovites* and *Coſſacks* in *Jan.* 1655 at the Siege of *Bichow* in *White-Ruſſia*; all their Proviſions of *Spaniſh Wines* or *Peterſimen*, and Beer, were in one Night *Frozen* upon the Sleds, notwithſtanding they were covered with Straw; in ſo much that they were conſtrained to carry them into a Stove, to Thaw them, which they could not do in two whole Days, and were obliged to break the Veſſels, and put pieces of the *Ice Wine* into Kettles to Thaw them over the Fire, for Drink. But he obſerved that the *Hungarian Wine* reſiſted the Cold better than the *Peterſimen*: for it was not ſo much *Frozen*, unleſs it be that the Butler tranſported it ſooner into the Stove. That the Scrue of a Flagon of *Aqua vitæ* being put to his Mouth, ſtuck cloſe to his Lips, that he could not draw it off without drawing Blood.

That the Pool of the Village (where they Quartered) was ſo thoroughly *Frozen*, that there was but very little Water left between the *Ice* and the Bottom.

That *Jan.* 2. 1665. the *Froſt* was ſo bitter in *Poland*, That 3 Souldiers dyed of it in paſſing a long Ditch; and that divers Perſons loſt ſome of their Limbs. *ib. p.* 352.

LIII. 1. The paſt *Winter* 168$\frac{3}{4}$. has been ſo Severe in my Territories, and where it could expugne the more defenſible and ſuch as were incloſed, it has Ravag'd all that lay open, and were abroad, without any mercy.

The Effects of the Froſt 1683-4. *By* Mr. J. Evelyn, n. 158. p. 559.

As to *Timber-Trees*; I have not many here of any conſiderable Age or Stature, except a few *Elms*, which (having been decayed many Years) one cannot well find to have received any freſh Wounds, diſtinguiſhable from old Cracks and Hollowneſſes; and indeed I am told by divers, that *Elms* have not ſuffered as the great *Oaks* have done; nor do I find amongſt innumerable of that Species (*Elms*) which I have Planted, and that are now about 25 and 30 Years ſtanding, any of them touched: The ſame I obſerve of *Limes*, *Walnuts*, *Aſh*, *Beach*, *Horn-beams*, *Birch*, *Cheſnut*, and other Forreſters. But as I ſaid, mine are Young comparatively; and yet one would think, that ſhould leſs Protect them, becauſe more Tender: So as it ſeems the Rifting ſo much complain'd of, has happen'd chiefly among the overgrown Trees, eſpecially *Oaks*. My Lord *Weymouth* made his Lamentation to me, and ſo has the Earl of *Cheſterfield*, Lord *Ferrers*, Sir *William Fermor*, and others concerned in the ſame Calamity; which I mention, becauſe of their diſtant habitations. But if rightly I remember, one of theſe Noble Perſons lately told me, that ſince the *Thaw*, the Trees which were exceedingly Split, were come together and cloſed again, and I eaſily believed it; but that they are really as Solid as before, I doubt will not appear, when they ſhall come to be examined by the Axe, and converted to uſe. Nor has this Accident happen'd only to Standing Timber, but to that which has been fell'd and ſeaſon'd, as Mr. *Shiſh*, the Maſter Builder in his Majeſty's Ship-Yard here, inform'd me.

As for *Exotics*; I fear my *Cork Trees* will hardly recover. The *Conſtantinopolitan* or *Horſe-Cheſnut* is Turgid with Buds, and ready to explain its Leaf. My *Cedars* I think are loſt: The *Ilex* and *Scarlet-Oak* not ſo: The *Arbutus*, doubtful, and ſo are *Bays*; but ſome will Eſcape, and moſt of them repullulate and Spring afreſh, if cut down near the Earth, at the latter end of the Month. The *Scotch-Fir*, *Spruce*, and White *Spaniſh* (which laſt uſes to ſuffer in their tender Buds by the *Spring-Froſts*) have received no damage this *Winter*, I cannot ſay the ſame of the *Pine*, which bears the greater Cone, but other *Norways* and *Pinaſters* are Freſh. *Laurel* is only diſcoloured, and ſome of the woody Branches Mortified, which being cut to the quick will ſoon put forth again, it being a Succulent Plant. Amongſt our *Shrubs*, *Roſemary* is intirely loſt, and ſo univerſal (I fear) is the deſtruction of this excellent Plant (not only over *England*, but our Neighbour Countries more Southward) that we muſt raiſe our next hopes from the Seed. *Halimus*, or Sea-Purſlain, (of which I had a pretty Hedge) is alſo periſhed, and ſo another of *French-Furſes*: The *Cypreſs* are all of them ſcorched, and ſome to death, eſpecially ſuch as were kept Shorn in Pyramids: but amongſt great Numbers, there will divers eſcape, after they are well *Chaſtiz'd*, that is with a tough Hazel or other Wand, to beat off their dead and duſty Leaves, which growing much cloſer than other Shrubs, hinder the Air and Dews from refreſhing the Interior parts. This Diſcipline I uſe to all my *Tonſile Shrubs* with good ſucceſs, as oft as a Winter parches them. The Berry-bearing *Savine* (which if well underſtood and cultivated were the only beſt *Succedaneum* to *Cypreſs*) has not ſuffered in the leaſt, it perfectly reſembles the *Cypreſs* and grows very Tall and Thick. I think the *Arbor Thuya* is Alive, and ſo is the *American Acacia*, *Acanthus*, *Paliurus*, *Pomgranate*; my *Lauruſtinus* looks ſuſpiciouſly: Some large and old *Alaternus*'s are kill'd, eſpecially ſuch as were more expoſed to the Sun, whereas thoſe that grow in the Shade eſcape; the reaſon of which I conjecture to be, from the Reciprocations of being ſomewhat relaxed every Day, and then made Rigid and Stiff again all Night, which bending and unbending ſo often, opening and cloſing the Parts, does exceedingly Mortify them, and all other tender Plants, which growing in ſhady places undergo but one Thaw and Change. Moſt of theſe yet will Revive again at the Root, being cut cloſe to the ground. The *Phillyrea's anguſti*, and *Serratifolio's* (both of them incomparably the beſt for Ornamental Hedges of any the *Perennial Greens* I know) have hardly been ſenſible of the leaſt Impreſſion, more than Tarniſhing of their Leaves, no more have the *Spaniſh Jaſmines*, and *Perſian*; and I enumerate theſe particulars the more minutely, that Gentlemen who are curious, may take notice what Plants they may truſt to abroad, in all Events, for I ſpeak only of ſuch as are expoſed.

I need ſay nothing of *Holly*, *Yew*, *Box*, *Juniper*, &c. (Hardy, and ſpontaneous to our Country) and yet to my Grief I find an *Holly* Standard of near 100 Years old, drooping and of doubtful Aſpect, and a very beautiful Hedge (tho indeed much younger) being Clip'd about *Michaelmas*, is mortified near a foot beneath the Top, and in ſome places to the very ground, ſo as there's nothing ſeems proof againſt ſuch a *Winter*, which is late cut, and expos'd. This Hedge does alſo grow againſt the South, and is very Ruſſet, whilſt the contrary ſide is as freſh and green as ever: and in all other places of my Plantations that are ſhaded, the Unſhorn *Hollies* maintain their Verdure, and are I judge Impregnable againſt all Aſſaults of *Weather*.

Among the *Fruit-Trees*, and *Murals*, none ſeem to have ſuffer'd ſave *Figs*, but they being cut down, will Spring again at the Root. The *Vines* have eſcaped, and of the *Eſculent Plants* and *Salads* moſt, except *Artichokes*, which are univerſally loſt, and (what I prefer before any *Salad* whatever Eaten Raw, when young) my *Sampire* is all rotted to the very Root: How to repair my loſs, I know not, for I could never make any of the Seed, which came from the *Rock Sampire* (tho' mine were of the very Kind) to Grow.

The *Arboreſcens* and other *Sedums*, *Aloes*, &c. (tho' hous'd) periſhed with me; but the *Yucca*, and *Opuntia* eſcaped. *Tulips* many are loſt, and ſo the *Conſtantinople Narciſſus*, and ſuch *Tuberoſa* as were not kept in the Chimney-Corner where was continual Fire. Some *Anemonies* appear, but I believe many are rotted: But I have made no great ſearch in the flowery Parterr, only I find that moſt Capillaries Spring, and other Humble, and repent Plants notwithſtanding all this Rigorous Seaſon.

My *Tortoiſe* (which by his conſtant burying himſelf in the Earth at approach of Winter, I look upon as a kind of Plant-Animal) happening to be obſtructed by a Vine-Root, from Mining to the depth he was uſually wont to Interr, is found ſtark dead, after having many Years eſcaped the ſevereſt Winters. Of *Fiſh* I have loſt very few, and the Nightingales (which for, being a ſhort winged Bird, and ſo exceeding Fat, at the time of the Year, we commonly ſuppoſe them to change the Climate: (whereas indeed they are then hardly able to Flie an Hundred Yards) are as Briſk and Frolick as ever, nor do I think they alter their Summer Stations, whatever become of them all Winter.

By Mr. Jacob Bobart, n. 165. p. 766.

2. In this Rigid Seaſon nothing ſeemed more Surpriſing to us, nor more generally known to be true, than the Cleaving or *Splitting* of Trees, as of the *Elms* by Mr. *Langley*'s Houſe the Miniſter of *Tamworth*, and *Aſhes* of conſiderable Bulk and Value, deſigned for and capable of diverſe uſes, as *Wil-Mil-Poſts*, Dreſſer-boards, and other neceſſary occaſions. Alſo *Wallnut Trees* in diverſe places have ſuffered by this Calamity, and proved extreamly *Cleft*, tho' indeed it hath been moſt frequent among *Oaks*, many of which have been divided to great Detriment in *England*, ſome being ſo rent that a Man may ſee through them, and that many times the Cracks came with ſo great Noiſe, that as it is related from *Needwood-Forreſt* they made ſuch a Noiſe, that the Keepers there thought that the Deer were ſhot by the People of the Country, and that in ſeveral parts they were heard as loud as Guns, ſome having been cruelly affrighted, eſpecially in the Evenings or Nights, as they have paſſed within the hearing of this ſo unexpected and ſurprizing a *Noiſe*. Which *Rifts* or *Clefts* were not at all to the ſame point of the Compaſs, but ſometimes on one ſide only, ſometimes 2, and ſometimes 3, and ſometimes 4 ſeveral places, Dividing or quartering the Tree, and ſometimes quite through: And theſe *Clefts* were not only in the Bodies, but continued into the larger Boughs and Limbs of the Tree, and ſometimes deſcended into the Superficial Roots, but not to thoſe very deep in the Earth: the *Froſt*, though extream, not reaching conſiderably deep, comparatively to the *Roots* of *Trees*, and the hard binding of the Earth being ſo *Frozen*, would not eaſily admit of compreſſure: But ſeveral ſhallow *Roots* ſo knotted and knurled as not to be wrought upon with Beetle and Wedges, are known to be *Cleft* by the *Froſt*. But it it much to be doubted and ſuſpected whether any ſuch *Cloven* Trees were ſo perfectly Sound and Faithful Timber, if proved by the Saw and Axe, as they ought to be, for if ſo, all might equally ſuffer, the Air having impartial acceſs to one as well as the other, but ſome being taken with this Diſeaſe, and others left untouch'd, there certainly was ſome Cauſe or Defect in thoſe Liable to it, rather than the reſt. A great part of the Cauſe of it is ſuppoſed to be Imperfection in ſuch a Tree, and that generally from the too large *Sap-Veſſels* and unnatural Cavities therein, which ſome call *Windſhaken*, and ſome *Lagg'd* Trees, the Cauſe whereof remains yet to be examin'd whether the *Shaking* of the Wind may not, with its great Weight

and Force, taking the whole Tree wich its Boughs, Limbs and Body, having one End firmly fixed in the Earth at ſome age or other, as well Work Wrack and make Splintering and ſtretched Pores, Paſſages, Cavities and ſuch like, in a live and growing Tree, at ſometimes of continuance of its force with its oft repeated Beating, Twiſting, and Preſſing Blaſts, as well as the beſt choſen Maſt of a Ship may ſuffer damage by the ſame Cauſe, even to Total Fraction. By ſome this is ſuppoſed to proceed from Earthquakes, but whether or not, is yet to be examined. But the Opinion of ſome ſeems not to be extravagant, who think it to be an Original Diſtemper in the Tree, and to proceed from the *Soil*, or rather an Innate Diſeaſe from ſome tho' undiſcernable Imperfection in the *Seed* it ſelf, and yet not ſo much but that they live many Years, and grow to great Bulk and Stature, but are obſerved to bear leſſer Leaves and ſmaller Acorns; but whether the *Soil* be concerned, may be urged, the Trees about *Oxford* Weſtward, being generally affected with this Diſeaſe, and thoſe from the Eaſt ſide prove excellent ſound Timber, and the *Soils* ſeeming to reſemble one another.

But by what means ſoever this may come, it is certain that ſome Trees are much more Sound than other, and that ſome prove full of inbred Diſeaſes and Cavities, before they are cut down, which Cavities and ſtretcht Veſſels being fill'd with too great a quantity of Aqueous and undigeſted *Sap*, as it were *Hydropical* (for it is thought that the Genuine and Natural *Sap* of theſe our Native Trees, though undergoing Condenſation, will remain ſecure and ſafe as may be ſuppoſed from thoſe that are well and firmly ſtanding) are thereby rendred capable of not only Condenſation but *Glaciation* alſo by the continuance and ſeverity of the Airs *Frigefactive* Power; which being ſufficiently known to employ more room being *Ice*, than formerly Liquid; might probably Cauſe theſe *Breaches*, and if we conſider the Expanſive Motion and Spring of the Air included in the Cavities of the *Air Veſſel*, ſuffering more Preſſure than they are patient of, from the *Coagulated* and Contiguous Aqueous parts then *Congealed*, may be induced to ſuppoſe theſe *Strepitous* Eruptious to proceed from thence. But whether Mr. *Hobb*'s Hypotheſis will certainly hold, that the Swelling is cauſed by the Intruſion of the Air, is ſomewhat to be doubted.

It need not prove troubleſome to any to think the *Ice* to be able to *Tear* the *Oakes* or other Trees, who ſhall conſider the great Force and Elaſtick Power thereof; whereof that moſt Excellent and Curious Philoſopner of our Age Eſquire *Boyle* hath, in his *Hiſtroy of Cold*, ſet forth ſeveral Experiments and Examples, as Veſſels of ſeveral kinds of Metals being made ſtrong on purpoſe, and fill'd with Water, cloſe ſtopp'd and expoſed to the *Cold*, which being not capable of withſtanding the Expanſive Force of the incloſed *Ice*, having been found *Cleft* and Broken; as for inſtance, the ſtrong Barrel of a Gun cloſe ſtopped, with Water in it, and *Frozen*, hath proved Rent long ways, and never a croſs the Veſſel, nor Bodies of the Trees we here mention. Another time a Braſs Veſſel of a Cylindrical form being made not more than five Inches deep and not two Diameter, filled with Water and afterwards *Frozen*, in one Night lifted off the Cover prepar'd and cloſely fitted, with a Weight of 56 pounds that was laid upon it. *Olearius*, Secretary to the Duke of *Hölſtein*'s Embaſſy into *Ruſſia*, tells us, that in the City of *Moſcow* he obſerved (the *Cold* being very intenſe) the Earth to be cleft many yards in length, and a Foot broad, which according to conjecture was occaſioned by the Heaving and Swelling thereof to enlarge its Room, as here we ſee Ice crackt and cleft conſiderably long and broad, according to its thickneſs along the ridge, or turgid part thereof. And that the Earth doth ſo riſe when frozen is eaſily made manifeſt by little Sticks or Plants ſet into the Ground againſt the approaching Winter, which being riſen 2 or 3 Inches or more, according to the depth and ſtrength of the Froſt, and upon the Thaw the Earth ſinking to its former Station, leaves the unfixed Plants with their Roots naked above ground, as it were ſpewed out. And not ſuch moiſt Bodies only, but Metals, as Braſs, Iron, &c. having been ſwelled in the time of being frozen, as hath been proved by Clocks, Locks and other Inſtruments, and become laxed and pliant again upon the Thaw. Many more Examples might be eaſily produced to induce us to the Thoughts, that the Sap is not right and genuine in ſuch ill diſpoſed Trees, and that Ice might, upon due Examination, be found in any ſuch burſten Bodies, as we are informed have been found and obſerved by ſome; and if Ice, then Preſſure, and if Preſſure then Breaking and Exploſion.

It may be doubted too, whether ſome of theſe Trees thus liable to the Fury of the Froſt, have not been *Coltie*? A Term commonly uſed among *Timber-Merchants*, and by them avoided; which is, towards the middle of the Tree, among the *Annual Circles*, ſome one is much larger than the reſt, and the *Sap-veſſels* there ſeem much extended beyond their Fellows, and upon cleaving or ſawing ſuch a Tree, that incloſed or inward Heart, Part thereof where that Circle is, will ſlip and drop from the other Part oft-times without any Force to divide it, as an Inſtrument out of a Caſe or Mould made fit for it.

Some ſuppoſe that theſe *Windſhaken* or *Iagg'd* Trees may be known or nearly gueſſed at by the outſide, when growing, by the great Ribbs, 2, 3, or 4 in a Tree from the Bottom to the Branches, and that they have been affected ſomewhat conſiderably with this Diſeaſe before, and perhaps cleft, (tho' not in ſo great a meaſure as now) and the Fiſſures cloſed up again; as we ſee theſe to do quickly after the Froſt, inſomuch that it is ſcarce diſcernable already, and the Bark having not been divided from the Body, upon coming together again, each turn and twiſt of the Grain fitting its Place, prove freſh and vigorouſly growing: But that ever ſuch Trees will prove whole and ſound, doth ſcarcely conſiſt with Reaſon or our preſent thoughts. And this Calamity hath not been found in only Trees that were freſh and ſtanding, but alſo in Trees cut down, as is affirmed by Mr. *Skiſh* and others, but notwithſtanding it is thought to be only among ſuch diſeaſed Trees as are before mentioned.

But it is yet to be queſtioned whether *Vines* have proved cleft and crackt along the Bodies by the ſame way and reaſon as *Timber-Trees*, which decay is eſpecially to be ſeen on Walls expoſed to the ſouthern Aſpect, ſo that the Sun our accuſtomed Friend now proved our great Enemy, by thawing and relaxing the Sap every Day, and then being frozen and made ſtiff again every Night; which often Repetition of bending and unbending, ſoftning and hardning, the vivid ſpirituous Juice being deſtroyed, and Day and Night the Drought vigorouſly acting, (the Sap being this Year diſordered and ſurprized, not gradually ſeaſoned, even before *Michaelmas-Day*, and the freſh Sap to ſupply its Defects being wholly detained from ariſing, there then being none or very little Exhalations or Evaporations ariſing out of the frozen and bound Earth) theſe poor ſlender Bodies fill'd only with thin and not viſcous *Sap*, have proved as great Sufferers as if by Amputation they had been deprived of their natural Suſtenance; for if they could have none from the Earth, and their own true Juice mortified, and it be certain that *omne Siccum appetit humidum*, it will follow, that ſuch Branches will by the Conſtancy and Continuance of ſuch Severity (the Day being as bad as the Night) prove as dry as Sticks cut off long before: whereas thoſe of this kind and other ſorts alſo growing in more ſhadowy parts, and undergoing but one Change, have remained in good Condition, eſpecially among red Grapes, which ſeem much more hardy than white ones.

We ſee other *Wall Fruits* on the ſame poſition, as *Apricocks*, *Peaches*, *Plums*, *Cherries &c.* are not at all injured or prejudiced by the Weather. which are of a more clammy viſcous juice: Theſe we ſee run ſometimes and give *Gum*, but the Leakage of *Vines* is as thin as Water, which different *Juices* and *Saps* in other Trees, and the degrees thereof, as well thoſe with deciduous leaves, as *Ever-greens*, may prove ſome Cauſe of the Weakneſs and Decay of ſome, whilſt that of another ſort ſtanding by, remains freſh and vigorous, only ſtagnated, ſedate and quiet, waiting for the benign Sun's Beams to actuate, lenifie, and put its Spirits in Motion, and its comfortable Refreſhment to ariſe in due Seaſon: And perhaps according to the Degree of this Qualification in Trees and Plants, (ſome being much more ſluggiſh than other) may be the Cauſe of their earlier or later *Germination*.

It is eaſily obſerved, that in dry, mountainous, rocky and barren Plantations, where Trees, Greens, and other Plants, having been ſparingly fed, and not pamper'd with ſuch Luxuriance and Freeneſs of Sap, as in the Valleys and richer Soils have eſcaped tolerably well: and by this which in other Years proves their Poverty and Diſeaſe, now make them inſult over thoſe growing in the fatter Vallies, proportional to the height of the Hills they grow on.

We may obſerve *Trees* all the Winter, while the *Sap* remains condenſed, to be ſafe and well, but if a flattering too early Glance happens in the Spring to ſet their Parts in Action, and the *Juices* to become fluid, and a ſudden mutation of that warmth to a freſh Return of Winter, (which too frequently happens in *England*) that then we have not only our hopes of that Year's Fruit blaſted, but even the Paſſages in the Branches and Boughs ſtopped, and the crude *Sap* ſettling, commonly called *Bliting*, (tho' there be many Cauſes of the Effects which go under that Notion) becomes a Diſeaſe in Trees equal to that of *Chil-blanes* in juvenile Blood, which ſometimes takes whole Trees, and ſometimes Branches only: Hence is ſuppoſed the Decay of the *Glaſtonbury Thorn*, whoſe Ariſing-time being between *Michaelmas* and

Chriſtmas, being ſappily prepared, by the Beginning of the hard *Froſt*, which hath almoſt affrighted it out of its Life.

Some Trees and Shrubs ſeem to have their Veſſels and Paſſages ſo ſtreightned, and as it were ſhrunk with *Cold*, that they appear equal to a human Body *Sinew-ſhrunk* or *Paralytick*, that is not without much Trouble able to move or bear his decaying Limbs: Thus we ſee *Trees* with their Bark ſhrivel'd, with their Paſſages half ſtopt, whoſe *Sap* now only ſqueezing, and difficultly paſſing, hath much ado to force its way thro' the dry'd and narrow Pores and Paſſages of the Body and Branches: and ſometimes this Diſtemper is ſo prevalent, that whole Branches of a Tree are killed, when the other part is indifferent well.

Some Liquids, ſuch as *Eſſential Oyls*, do rather ſhrink than increaſe being frozen, and *Empyreumatical Oyls*, will hardly freeze but waſte, which Conſiderations may introduce the Thoughts of what ſome *Trees* are made of. or do abound in, as *Firrs*, *Pines*, &c. which are capable of enduring the *Cold* of *Norway*, and other Countries.

What *Timber-Trees* have ſuffered, are above ſpecified, but divers others of our native *Trees* and *Shrubs* have ſcarcely proved able to withſtand the force of ſo rude an Enemy, *Yew* and *Holly* (things whoſe Tenderneſs was never ſuſpected) were in ſome places quite kill'd, and in many places ſo diſcouraged, looſing their Leaves, and blemiſhing the Bark, that it is to be feared they will never take on their priſtine Splendour and Verdure. The *Furze* in many places quite kill'd, and in moſt places cut down and ſpring again, but often the Reſurrection in vain expected. Common *Broom* proves a degree hardier. In ſome places the ſunny Side of a *Juniper Buſh* proves ſcorcht between Sun and Cold, but that proves one of the moſt hardy of our native *Greens*; ſo that it is hard to ſay what is Winter-proof even among our Natives, except *Box* and *Ivy*, which ſtand in Defiance of all.

In the Gardens (which generally are Nurſeries of *Exoticks*, and from warm Countries) this Calamity hath principally bent its force againſt *Winter Greens* ſuch as *Alaternus* (commonly known by the Name of *Phillyrea*) and the true *Phillyrea* alſo, which are generally kill'd; tho' ſome upon cutting down ſpring again. Alſo common *Bays* ſeen in moſt places to be kill'd down, and *Lawrel* ſeldom proving impatient, is in ſome places kill'd, in ſome places half dead; *Roſemary*, *Laurustine*, *Halimus*, *Arbutus*, *white Jeſſamine*, and other which ſeldom fail, are generally kill'd thro' the whole Country. But in all theſe and other ſuch like, in mountainous and dry Places (as was before obſerved) there is briſk Life and Verdure yet remaining, tho' rarely to be met with, but however enough to retain the ſeveral *Species* among us. But if for the future in ſuch times of Extremity, the Superficies of the Ground, and Bodies of ſuch things here recited, and *Fig-trees* were well covered with ſtrawy matter to keep off the Froſt, it might ſo preſerve them as to ſpring out plentifully the Spring following, tho' their whole Tops being too large and high, and thereby incapable of ſuch covering, might loſe their preſent Leaves and Beauty; which might from ſuch reſpringing be eaſily repaired, and prove much more ſatisfactory than to begin the World anew, as we are generally forc'd to do for *Cypreſſes*, which were uſed to be excellent ornaments both in ſummer and winter, now it proving a very rare thing to ſee one well alive; In ſome places there appears ſome lingring Life, but ſcarcely ſufficient to recover the whole, but in moſt places they are quite dead, that have faced 40, 50, or 60 Winters before.

Alſo among thoſe with *Deciduous Leaves*, divers have been Sufferers, as *Arbor-Judæ*, young *Plane Trees*, tho' thoſe of conſiderable Stature have pretty well eſcaped, *Paliurus*, the *Aleppo Aſh*, in ſome Places the *Locuſt Tree*, and in moſt Hedges the great common Bramble, and ſome other, which upon cutting, do ſome or moſt of them ſpring again.

But ſuch *Greens* alſo as we receive from, and are the Glory of warmer Countries, and very rare, curious and pleaſant with us, ſuch as *Oranges*, *Lemons*, *Myrtles*, *Pomegranates*, and the perfuming *Jaſmines*, and divers other Rarities, which are uſually kept in Pots and Caſes for the Convenience of removing them into *Green-Houſes* and *Conſervatories*, not being able to endure our milder Winters, have in many places extreamly ſuffered, eſpecially in Houſes of weaker Defence: but where the Skill, Care, and due Management of their Keepers, have met with the Convenience of good warm Houſes, with keeping conſtant Fires, (which is a Matter to be regulated with great Diſcretion) according to the Proportion of which combining Qualifications the Plants have eſcaped; as in ſome places moſt of them are well, in ſome places half, and in ſome places all dead.

Among *Plants*, *Herbs*, and *Flowers*, there hath been great Deſtruction alſo, and many of common uſe as moſt of the *Arcichokes* in *England*, and *Winter Coleflowers*, *Sage*, *Tyme*, *Maſtick*, *Lavender*, *Laven-Cotton*, and divers other were generally kill'd: Except ſuch as happened to be new planted that Year, and ſo low, that they had the Enjoyment of the kind covering of a little *Snow*, which proves the moſt natural Feeding and warm Covering, of any thing to be mention'd; but what peeped its Head above it ſeemed in great danger of being kill'd; and as we may ſee in the *Corn-fields*, that thoſe ſides of the Lands of Corn facing the South, where the Snow was melted, and the Corn deprived of its Covering, the want proved deadly, and in many places Husband-men were forced to begin again in the Spring to plough and ſow other Grain; which may eaſily teach as rather to heap *Snow* upon our Herbs and Flowers, than fanſie it a cold unkind Enemy.

But after all this Repetition of Sorrows, we are to comfort our ſelves that ſuch Deſtruction and Calamity happens but very rarely, the like having not been known in the memory of man, if ever before, and that with due care and obſervance the growing Cold might be kept off from ſuch things as are proved to be impatient of it; which are not all *Greens* in our Gardens, ſome being able to endure all the Cold that ever came, as *Firrs*, *Pines* of divers ſorts, *Cedars* of *Libanus* and *Virginia*, (tho' that of *Bermudas* proves tender) *Arbor Vitæ*, all the *Savins*, whereof the upright or *Berry-bearing* is the beſt *Succedaneum* to *Cypreſs*, capable of finer cutting into *Pyramids*, or other Figures, or Hedges 6 or 8 Foot high, and is one of the beſt of the *Tonſile Shrubs*; alſo the *Pyracantha* proves exceeding hardy, and makes good Hedges.

LIV. The

To Preſerve Ice and Snow, by Mr W. Ball n. 8 p. 139.

LIV. The *Snow* and *Ice-houſes* at *Livorne*, are commonly built on the ſide of a ſteep Hill, being only a deep Hole in the Ground, by which means, they eaſily make a Paſſage out from the Bottom of it, to carry away all the Water; which if it ſhould remain ſtagnating therein, would melt the *Ice* and *Snow*: But they thatch it with Straw, in the ſhape of a Sauce-pan Cover, that the Rain may not come at it. The Sides (ſuppoſing it dry) they line not with any thing, as is done in St. *James's* Park, by reaſon of the Moiſtneſs of the Ground. This Pit they fill full of *Snow* or *Ice*, (taking Care that the *Ice* be made of the pureſt Water, becauſe they put it into their Wine) overſpreading firſt the Bottom very well with *Chaff*, but without any part of the Straw; I think they uſe *Barley-chaff*. This done, they further, as they put in the *Ice* or the *Snow*, (which latter they ram down) line it thick by the Sides with ſuch *Chaff*, and afterwards cover it well with the ſame; and in half a Year lying ſo, 'tis found not to want above an 8*th* part of what it weighed when firſt put in. Whenever they take it out into the Air, they wrap it in this Chaff, and it keeps it to Admiration.

Cold produced with Sal Armoniack; Mr. R. Boyl, n. 15. p. 255.

LV. Among ſeveral ways, by which I have made *infrigidating* Mixtures with *Sal-Armoniack* the moſt ſimple and facile is this: Take one Pound of powder'd *Sal-Armoniac* and about three Pints, (or Pounds) of Water, put the *Salt* into the Liquor, either all together, if your deſign be to produce an Intenſe, tho' but a ſhort *Coldneſs*; or at two, three, or four ſeveral times, if you deſire that the produced *Coldneſs* ſhould rather laſt ſomewhat longer than be ſo great. Stir the Powder in the Liquor with a Stick or Whalebone (or ſome other thing, that will not be injured by the fretting Brine that will be made) to haſten the Diſſolution of the *Salt*; upon the Quickneſs of which depends very much the Intenſity of the *Cold*, that will enſue upon this Experiment.

That a conſiderable degree of *Cold* is really produced by this Operation, is very evident: *Firſt*, to the Touch; *Secondly*, by this, that if you make the Experiment (as for this Reaſon I ſometimes chuſe to do) in a Glaſs Body, or a Tankard, you may obſerve, that whilſt the Solution of the *Salt* is making, the outſide of the metalline Veſſel will, as high as the Mixture reaches within, be bedewed (if I may ſo ſpeak) with a Multitude of little Drops of Water, as it happens when Mixtures of *Snow* and *Salt*, being put into Glaſſes or other Veſſels, the aqueous Vapours that ſwim to and fro in the Air, and chance to glide along the ſides of the Veſſels, are by the Coldneſs thereof condenſed into Water. But *Thirdly*, the beſt and ſureſt way of finding out the *Coldneſs* of our Mixture, is by plunging into it a good ſeal'd *Weather-glaſs* furniſh'd with tincted Spirit of Wine. For, the Ball of this being put into our *Frigorifick* Mixture, the crimſon Liquor will nimbly enough deſcend much lower, than when it was kept either in the open Air, or in common Water, of the ſame Temper with that wherein the *Sal-Armoniack* was put to diſſolve. And if you remove the Glaſs out of our Mixture into common Water, the tincted Spirit will re-aſcend; and this has alſo ſucceeded with me when I remov'd it into Water newly impregnated with *Salt Petre*.

This *Cold* in Summer and hot weather will ſoon decay and expire: But if the Quantity of the *Salt* and *Water* be great, the Effect will be as well more laſting as more conſiderable. I have reaſon too to ſuſpect, that there may be a conſiderable Diſparity as to their Fitneſs to produce *Cold* betwixt ſeveral Parcels of *Salt* that are without Scruple look'd upon as *Sal-Armoniack*. I have alſo often found, that when the tincted Liquor ſubſided but ſlowly, or was at a Stand, by putting in from time to time 2 or 3 Spoonfuls of freſh *Salt*, and ſtirring the Water to quicken the Diſſolution, the *Spirit* of *Wine* would begin again to deſcend, if it were by a Stand or Riſing, or ſubſide much more ſwiftly than it did before. And if you would lengthen the experiment, it may not be amiſs that part of the *Sal-Armoniack* be but groſly beaten that it may be the longer in diſſolving, and conſequently in cooling the Water. After this Manner a ſenſible adventitious *Cold* has been made in the Spring, by a Pound of *Sal-Armoniack* at the utmoſt, to laſt about 2 or 3 Hours

Experiments in *March* 27. The tincted Spirit in the ſeal'd *Weather-Glaſs*, when firſt put into the Water, reſted $8\frac{1}{8}$ inches: Being ſuffered to ſtay there a good while, and now and then ſtirr'd to and fro in the water, it deſcended at length a little beneath $7\frac{1}{8}$ inches. Then the *Sal-Armoniack* being put in, within about a quarter of an hour or a little more it deſcended to $2\frac{1}{8}$ inches, but before that time, in half a quarter of an hour it began manifeſtly to freeze the Vapours and Drops of Water on the outſide of the Glaſs. And when the *Frigoriſick* Power was arrived at the height, I ſeveral times found, that Water thinly placed on the outſide, whilſt the Mixture within was nimbly ſtirr'd up and down, would freeze in a Quarter of a Minute, by a Minute-Watch. At about ¾ of an hour after the after the *infrigidating* Body was put in the *Thermoſcope*, that had been taken out a while before, and yet was riſen but to the loweſt freezing Mark, being again put in, the Liquor fell an Inch beneath the Mark. At about $2\frac{1}{2}$ Hours from the firſt Solution of the *Salt*, I found the tincted Liquor to be in the midſt between the freezing Marks, whereof the one was at $5\frac{1}{2}$ Inches (at which height when the Tincture reſted, it would uſually be, ſome, tho' but a ſmall, *Froſt* abroad; and the other at $4\frac{1}{4}$ inches; which was the Height, to which ſtrong and durable *Froſt* had reduced the Liquor in the Winter. At 3 hours after the beginning of the Obſervation, I found not the crimſon Liquor higher than the upper Freezing Mark newly mentioned; after which it continued to riſe very ſlowly for about an Hour longer; beyond which Time I had not occaſion to obſerve it.

2. This *Frigoriſick* Mixture having been made in a Glaſs-Body, (as they call it) with a large and flattiſh Bottom, a Quantity of Water, which I (purpoſely) ſpilt upon the Table, was by the Operation of the Mixture within the Glaſs, made to freeze, and that ſtrongly enough, the Bottom of the Cucurbite to the Table; that ſtagnant Liquor being turned into ſolid Ice, that continued a conſiderable while unthaw'd away, and was in ſome places about the Thickneſs of a Half-Crown-piece.

3. At another time the ſame Spring the *Weather Glaſs*, which before it touched the common water ſtood at $8\frac{1}{8}$, having been left there a conſiderable while, and once or twice agitated in the Water, the tincted Liquor ſunk but to $7\frac{7}{8}$, or at fartheſt to $7\frac{6}{8}$, then the *Frigerifick* Liquor being put into the Water, with Circumſtances diſadvangeous enough, in (about) half a quarter of hour the tincted Liquor fell beneath $3\frac{1}{4}$; and the *Thermoſcope* being taken out, and then put in again, an Hour after the Water had been firſt *Infrigidated*, ſubſided beneath 5 Inches, and conſequently within $\frac{1}{4}$ of an inch of a Mark of the ſtrongly freezing Weather.

The grand thing that is like to keep this Experiment from being generally uſeful, is the Dearneſs of *Sal-Armoniack*. But to leſſen this Inconvenience, two things may be offer'd; Firſt, that *Sal-Armoniack* might be made much cheaper, if inſtead of fetching it beyond Sea, our Country-men made it here at home. Secondly, That tho' an *Armoniack* Solution being boyl'd up in Earthen Veſſels (for Glaſs ones are too chargeable) will, by piercing them, both loſe ſome of the more ſubtile Parts, and thereby ſomewhat impair the Texture of the reſt; yet I was not deceived in expecting, that the dry Salt, remaining in the Pipkins, being re-diſſolved in a due Proportion of Water, would very conſiderably infrigidate it; as may farther appear by the following Experiment.

4. *Mar.* 29. The *Thermoſcope* in the *Air* was at $8\frac{7}{8}$ inches; being put into a ſomewhat large evaporating Glaſs, fill'd with Water, it fell after it ſtay'd a pretty while, and had been agitated in the Liquor, to 8 inches: then about half the Salt, or leſs, that had been uſed twice before, and felt much leſs cold than the Water, being put in and ſtirr'd about, the tincted Spirit ſubſided with a viſible Progreſs, till it had fallen manifeſtly beneath 4 inches; and then having cauſed ſome Water to be freſhly pump'd and brought in, tho' the newly mentioned Solution were mixt with it, yet it preſently made the Spirit of Wine manifeſtly to aſcend in the Inſtrument, much faſter than one would have expected.

The Length of the Cylindrical Pipe of the ſeal'd *Thermoſcope* wherewith theſe Obſervations were made was 16 inches; the Ball about the Bigneſs of a ſomewhat large Walnut, and the Cavity of the Pipe, by Gueſs, about an 8*th* or 9*th* part of an inch Diameter.

To cool Drinks with this Mixture, you may put them in thin Glaſſes, the thinner the better; which (their Orifices being ſtopp'd, and ſtill kept above the Mixture) may be moved to and fro in it, and then be immediately poured out to be drunk. By the Help hereof, Pieces of Cryſtal, or Bullets, for the cooling of the Mouth or Hands of thoſe Patients, to whom it may be allowed, may be potently cooled; and other ſuch Refreſhments may be eaſily procured. In which, and many other Uſes, it will not be requiſite to employ near ſo much as a whole Pound of *Sal Armoniack* at a time. For, you may eaſily obſerve by a ſeal'd *Weather-Glaſs*, that a very few Ounces, well powder'd and nimbly diſſolv'd in about 4 times the Weight of Water, will ſerve well enough for many purpoſes.

Experiments about Freezing; by S. Carlo Rinaldini, n. 72. p. 2169.

LVI. 1. A little Water being left at the Top of the *Mercury* in the *Torricellian* Experiment, and expoſed to the Air in froſty Weather, was in one Night congealed into *Ice* of a very good Conſiſtence. Afterwards, *Rinaldini* having compared this *Ice* with that which was produced in the open Air, found, that the *Ice* in the Cane was in ſubſtance altogether like that of *Hail*; that is, an Opaque and Whitiſh Body: Whereas that which was made in the Air was tranſparent like Cryſtal. Beſides, he obſerved that the *Ice* made in the Cane was heavier *in ſpecie* than that in the ambient Air, which he diſcover'd by putting it into a Fluid, which was *in ſpecie* lighter than Water, but heavier than *Ice* made in the open Air; whereby he found, that whereas the *Ice* made in the Cane ſunk, that in the Air floated therein.

By Dr. Liſter, n. 167. p. 835.

2. *Decem.* 3. 1684. at Night, I expos'd 4 Glaſs-Bottles in the open Air upon the Ground to freeze; *viz.* of the *Red-Natron-Water* from *Egypt*; of a ſtrong Solution of *Nitrum Murarium* in fair Water, of *Sea-Water* taken up at *Scarborough*, and more than half evaporated; of the *Sulphur-Well* at *Knaſborough*, that is, of *Natural-Brine* evaporated ~~to the~~ ſame height with the *Sea-Water*.

The 4*th* in the Morning, the Solution of *Nitrum Murarium* was half of it *Ice*, but not any of the reſt.

The 6*th* in the Morning, the Bottle of *Nitrum Murarium* was moſt *Ice*; the *Sulphur-Water* had no *Ice* that I could perceive at all in it; the *Natron* had much *Ice* at the Bottom of the Bottle; and the *Scarborough Sea-Water* was not without Flakes of *Ice*.

Fig. 21, 22.

The *Icicles* of the *Natron* were prettily figured, as is repreſented in *Fig.* 21. The *Icicles* of the *Sea* Water were alſo figured in oblong Squares, as in *Fig.* 22. And were brittle and tranſparent. I ſet the drained *Icicles* of *Natron* before the Fire, which did readily enough melt and diſſolve into Water again; this *Ice* was both alike ſalt in *Ice* and in *Water*, much like the Water, to the Taſte, out of which it was frozen. In like manner having drained the *Sea-Water-Ice*, and expos'd it before the Fire, theſe *Icicles* became ſoft and moiſt by Degrees, but at length rather evaporated than quite melted away; and having taken up a good thick Lump of common *Ice*, at leaſt 100 times their Thickneſs and Bulk, this in a few Moments at the ſame Diſtance before the Fire, grew wetter and wetter, and diſſolv'd into Water, whereas the *Salt Icicles* after 3 quarters of an Hour, lying before the Fire, did at length dry into a white Powder perfect ſalt, ~~the~~ Moiſture totally evaporating. Alſo the *Sea-Water Icicles* taſted very ſalt, when firſ taken out of the Water.

I repeated the ſame Experiment of expoſing to freeze the Bottles of *N tural Brine* of *Knaſborough Sulphur-Well*, half evaporated, and *Scarboroug* Sea-Water, the ſame as formerly, the 7*th* and *th* Inſtant at Night, and wit the like Succeſs, *viz.* no *Icicles* in the *Natural-brine*, but the ſame large one as above deſcribed I had in the *Sea-Water*, but not till after the 2*d* Night keen Freezing.

Theſe *ſalt Icicles* continued unthawed in the Bottles though they wer brought into the Houſe, and kept in a warm Room, long after all other I

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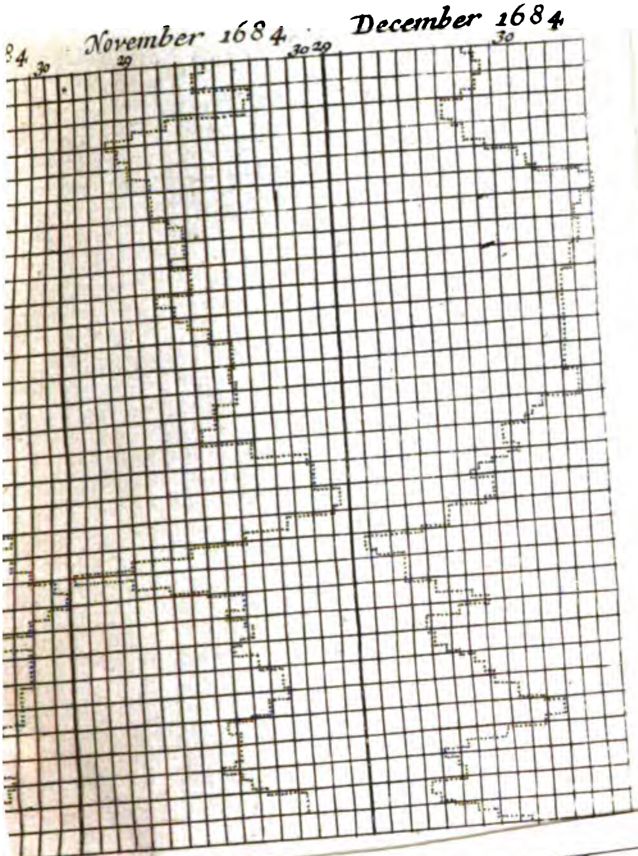
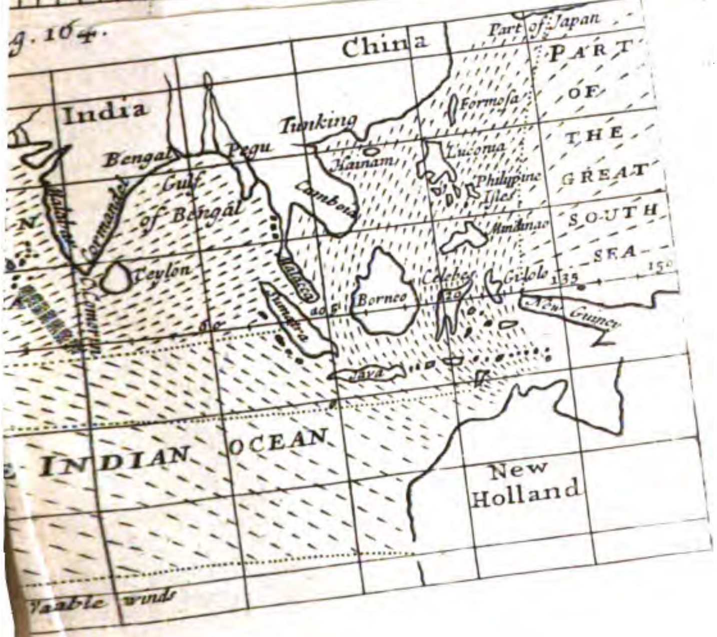




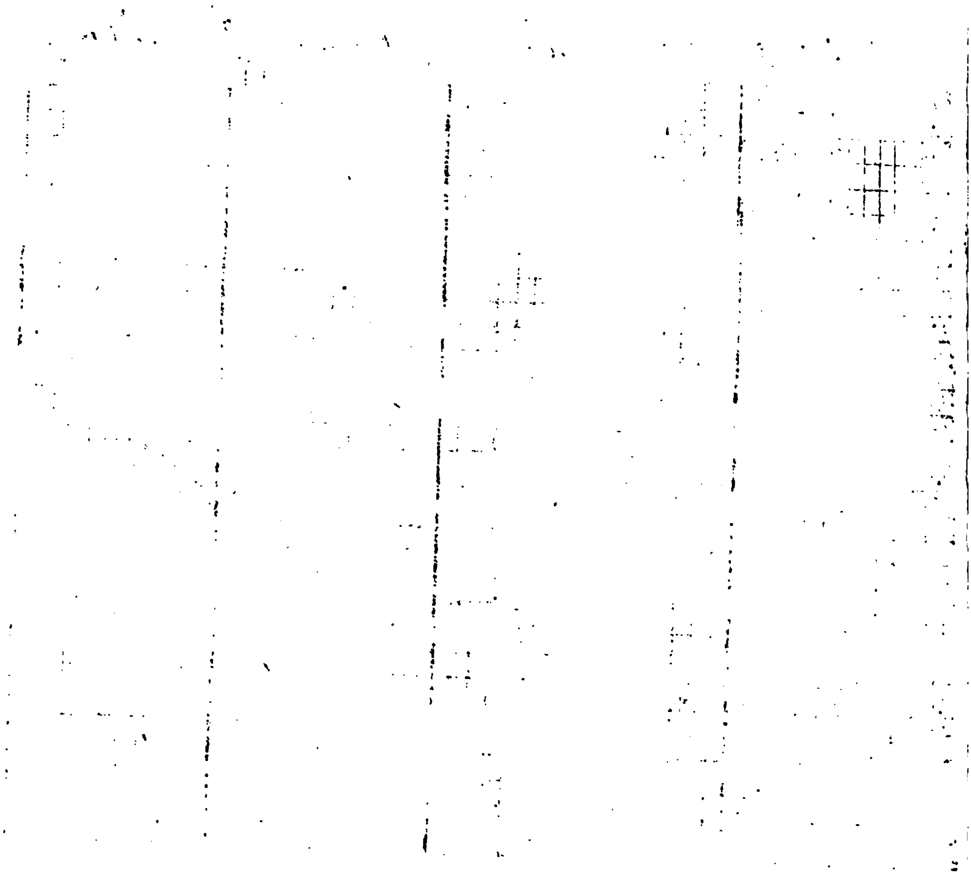
g. 164.

By M. Derh. Maſters, n. 245. p. 384. n. 247. p. 439.

Exceſſive Heats *in* Poland; *By* Mr. Fehre, n. 19. p. 352.

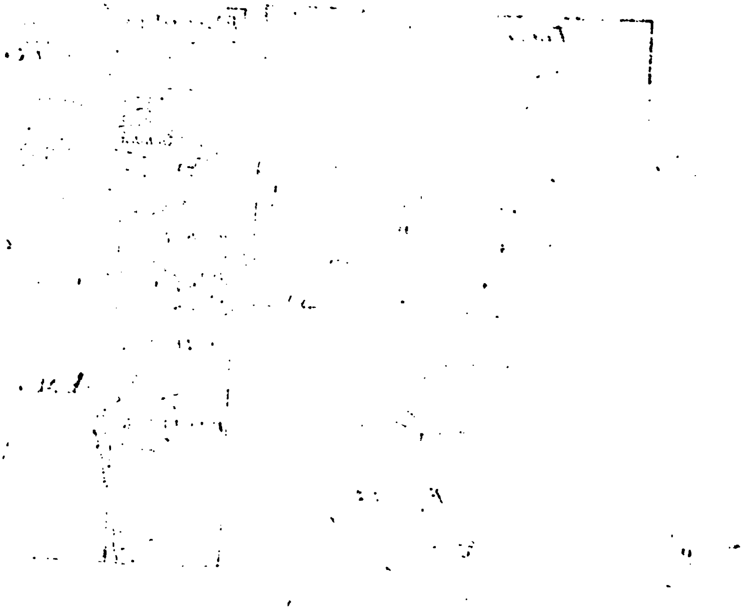
The Proportional Heat *of the* Sun, *in all* Latitudes; *by* Mr. Edm. Halley, n. 203. p. 878.

Experiments about freezing; *by* S. Carolo Rinaldini, n. 72. p. 2169.



By Dr. Lister. n. 167. p. 835.

Fig. 21, 22.



within Doors was gone; *viz.* 'till the 12 Inſtant at Night, when the *Icicles* alſo were diſſolved and vaniſh'd.

From theſe Experiments we Note, 1. That there may be *Salt-Ice* from *Sea Water Frozen*, which the Experiments of this *S.* of the laſt Year did not ſeem to favour.

2. That there is a real Difference betwixt *Natural Brine*, and *Sea-Water*; as there is betwixt the Salts themſelves, which they yield.

3. That the great Floating Mountains of Ice in the *Northern-Seas* (if upon ſtrict Tryal they ſhall be found to be Salt, which ſhould be further enquired into,) are not only the Effects of many Years Freezing, but alſo much of their Magnitude may be owing to the Natural Duration of that ſort of *Ice*.

3. A Tube of $\frac{1}{4}$ of an Inch Diameter being filled with Water, to the Height of 2 Inches, and ſet to *Freeze* in a Mixture of Snow and Salt, the Water, when perfectly Frozen, appeared $\frac{1}{16}$ of an Inch, above the Mark it ſtood at before Freezing

By M. Deſh Maſters, *n.* 245. p. 384. n. 247. p. 439.

Another Tube, of almoſt an Inch Diameter being fill'd with Water, to the Height of 6 Inches, and ſet to Freeze as before, roſe $\frac{7}{8}$ of an Inch above the Mark. The Water made uſe of in theſe Tryals, was, a ſort of rough *Pump-Water*; which, according to what Tryals have been made with it, does, upon the Effuſion of *Oil* of *Tartar per Deliquium*, immediately turn Milky and Turbid. And the Ice made of this Water was a ſort of very rarified White *Ice*.

The Tube of almoſt an Inch Diameter being fill'd to the height of 6 Inches (as before) with *River Water*, which would readily mix with *Oil* of *Tartar* without the leaſt Precipitation, and ſet to Freeze in a Mixture of Snow and Salt, it gained but $\frac{1}{8}$ of an Inch after it was Frozen; whereas the *Pump-Water* got $\frac{7}{8}$ of an Inch.

It was obſervable, that when the *Water* (in all theſe Experiments) began to Freeze, a great many ſmall Bubbles continually roſe from the Bottom.

A Tube being fill'd with *Boiled Pump-Water*, to the height of 6 Inches, and ſet to Freeze as before, it roſe hardly to $\frac{6}{8}$ of an Inch above the Mark, when as the ſame Water *Unboiled* roſe to $\frac{7}{8}$.

LVII. In *July* 1653. It was ſo furiouſly Hot in *Poland*, that in the Regiment of Foot which was the King's Guard, marching moſt of them Barefoot upon Sands, more than 100 fell down altogether diſabled, whereof a Dozen died outright, without any other Sickneſs.

Exceſſive Heats *in* Poland; *By* Mr. Fehre, n. 19. p. 352.

LVIII. If the Action of the *Sun* be conſidered as the only Cauſe of the *Heat* of the *Weather*, I ſee no reaſon but that under the *Pole*, the Solſtitial Day ought to be as hot as it is under the *Æquinoctial*, when the *Sun* comes Vertical or over the *Zenith*; for this reaſon, that for all the 24 Hours of the Day under the *Pole*, the *Sun*'s Beams are incined to the Horizon, with an Angle of $23\frac{1}{2}$ *Deg.* and under the *Æquinoctial*, though he come Vertical, yet he ſhines no more than 12 hours, and is again 12 Hours abſent, and that

The Proportional Heat *of the* Sun, *in all* Latitudes; *by* Mr. Edm. Halley, n. 203. p. 878.

For 3 hours 8 Min. of that 12 Hours he is not ſo much Elevated as under the *Pole*; ſo that he is not 9 of the whole 24 higher than 'tis there, and is 15 hours lower. Now the ſimple Action of the *Sun* is, as all other Impulſes or Stroaks, more or leſs Forceable, according to the *Sines* of the *Angle* of *Incidence*, or to the Perpendicular let fall on the Plain; whence the *Vertical* Ray (being that of the greateſt *Heat*) being put Radius, the force of the *Sun* on the Horizontal Surface of the Earth will be to that, as the *Sines* of the *Sun*'s Altitude at any other time: This being allowed for true, it will then follow, that the time of the Continuance of the *Sun*'s ſhining being taken for a *Baſis*, and the *Sines* of the *Sun*'s Altitudes erected thereon as Perpendiculars, and a Curve drawn through the Extremities of thoſe Perpendiculars, the Area comprehended ſhall be Proportionate to the Collection of the *Heat* of all the Beams of the *Sun* in that ſpace of time. Hence it will follow, that under the *Pole* the Collection of all the *Heat* of a *Tropical* Day, is Proportionate to a *Rectangle* of the *Sine* of 23½ *gr.* into 24 Hours, or the Circumference of a Circle; that is, the *Sine* of 23½ *gr.* being nearly $\frac{4}{10}$ of *Radius*, as $\frac{8}{10}$ into 12 Hours. Or the *Polar Heat* is equal to that of the *Sun* continuing 12 Hours above the Horizon, at 53 *gr.* height, than which the *Sun* is not 5 Hours more Elevated under the *Equinoctial*.

But that this matter may be the better underſtood, I have exemplified it by a Scheme, where in the Area *ZGHH*, is equal to the *Area* of all the Fig. 23. *Sines* of the *Sun*'s Altitude under the *Equinoctial*, erected on the reſpective Hours from *Sun*-riſe to the *Zenith*, and the *Area* ♋ *HH* ♋ is in the ſame proportion to the Heat for the ſame 6 Hours under the *Pole* on the *Tropical* Day, and ⊙ *HHQ*, is proportional to the collected Heat of 12 Hours, or half a Day, under the *Pole*; which ſpace ⊙ *HHQ* is viſibly greater than the other *Area HZGH*, by as much as the *Area HGQ* is greater than the *Area ZG* ⊙; which, that it is ſo, is Viſible to ſight, by the great exceſs, and ſo much in proportion does the Heat of the 24 Hours *Sun-ſhine* under the *Pole*, exceed that of the 12 Hours under the *Æquinoctial*: Whence *Cæteris paribus*, it is reaſonable to conclude, that were the *Sun* perpetually under the *Tropick*, the *Pole* would be at leaſt as Warm, as it is now under the *Line* it ſelf.

But whereas the Nature of *Heat* is, to remain in the ſubject after the Cauſe that heated is removed, and particularly in the Air, under the *Æquinoctial*, the 12 Hours abſence of the *Sun* does very little ſtill the Motion impreſs'd by the paſt Action of his Rays wherein *Heat* conſiſts, before he ariſe again: But under the *Pole*, the long abſence of the *Sun* for 6 Months, wherein the Extremity of *Cold* does obtain, has ſo chill d the Air, that it is as it were Frozen, and cannot, before the *Sun* has got far towards it, be any way ſenſible of his preſence, his Beams being obſtructed by the thick Clouds, and perpetual Foggs and Miſts, and by that *Atmoſphere* of *Cold*, as the late Honourable Mr. *Boyle* was pleaſed to term it, proceeding from the everlaſting *Ice*, which in immenſe quantities does Chill the neighbouring Air, and which the too ſoon retreat of the *Sun* leaves *Unthawed*, to encreaſe again during the long Winter that follows this ſhort Interval of Summer.

But the differing Degrees of *Heat* and *Cold* in differing Places, depend in a great meaſure upon the Accidents of the Neighbourhood of high Mountains, whoſe height exceedingly Chills the Air brought by the Winds over them; and of the nature of the Soil, which variouſly Retains the *Heat*, particularly the Sandy, which in *Africa*, *Arabia*, and generally where ſuch *Sandy Deſarts* are found, do make the *Heat* of the Summer incredible, to thoſe that have not felt it.

In proſecution of this Thought, I have ſolved this *Problem* generally, *viz.* *To give the Proportional Degree of Heat, or the Sum of all the Sines of the Sun's Altitude, while he is above the Horizon in any Oblique Sphere*, by reducing it to the finding of the Curve Surface of a *Cylindrick Hoof*; or of a given part thereof.

Now this *Problem* is not of that difficulty as appears at firſt ſight; for let the *Cylinder ABCD*, be cut obliquely with the *Ellipſe BKDI*, and by the Center thereof *H*, deſcribe the Circle *IKLM*; I ſay, the Curve Surface *IKLB* is equal to the Rectangle of *IK* and *BL*, or of *HK* and 2 *BL*, or *BC*: And if there be ſuppoſed another Circle, as *NOPQ*, cutting the ſaid *Ellipſe* in the Points *P*, *Q*; draw *PS*, *QR*, parallel to the Cylinders Axe, till they meet with the aforeſaid Circle *IKLM* in the Points *R*, *S*, and draw the Lines *RTS*, *QVP*, biſected in *T*, and *V*. I ſay again, that the Curve Surface *RMSQDP* is equal to the Rectangle of *BL* or *MD* and *RS*, or of 2 *BL* or *AD* and *ST* or *VP*; and the Curve Surface *QNPD* is equal to *RS* × *MD* — the Arch *RMS* × *SP*, or the Arch *MS* × 2 *SP*: or, it is equal to the Surface *RMSQDP*, ſubtracting the Surface *RMSQNP*. So likewiſe the Curve Surface *QBPO* is equal to the Sum of the Surface *RMSQDP*, or *RS* × *MD*, and of the Surface *RLSQOP*, or the Arch *LS* × 2 *SP*. Fig. 24.

This is moſt eaſily Demonſtrated from the Conſideration, That the *Cylindrick* Surface *IKLB* is to the Inſcribed *Spherical* Surface *IKLE*, either in the whole or in its Analogous Parts, as the Tangent *BL*, is to the Arch *EL*; and from the Demonſtrations of *Archimedes de Sphæra & Cylindro*, *Lib.* 1. *Prop.* 30. 37, and 38. and Doctor *Barrow*'s Learned *Lectures* on that Book, *Probl.* 9. and the Corollaries thereof.

Now to reduce our Caſe of the Sum of all the *Sines* of the Sun's Altitude in a given Declination and Latitude to the aforeſaid *Problem*, let us conſider the *Analemma* Projected on the Plan of the Meridian, *Z* the *Zenith*, *P* the *Pole*, *HH* the *Horizon*, *a a* the *Æquinoctial*, ♋ ♋ ♑ ♑ the two *Tropicks*, ♋ *I* the Sine of the Meridian Altitude in ♋; and equal thereto, but perpendicular to the *Tropick*, erect ♋ 1, and draw the Line *T* 1. interſecting the *Horizon* in *T*, and the Hour Circle of 6, in the Point 4, and 6,4 ſhall be equal to 6 *R*, or to the Sine of the Altitude at 6: And the like for any other Point in the *Tropick*, erecting a Perpendicular thereat, terminated by the Line *Ti* 1. Through the point 4, draw the Line 4 5 7 parallel to the *Tropick*, and repreſenting a Circle equal thereto; then ſhall the *Tropick* ♋ ♋ in *Fig.* 25. anſwer to the Circle *NOPQ*, in *Fig.* 24. The Circle 4 5 7, ſhall anſwer the Circle *IKLM*, *T* 4 *i* ſhall anſwer to the *Elliptick* Segment *QIBKP*, 6 *R* or 6 4 ſhall anſwer to *SP*, and 5 1 to *BL*, and the Arch ♋ *T*, to the Fig. 25.

Arch *L S*, being the Semidiurnal Arch in that Latitude and Declination; the Sine whereof, though not expreſſible in *Fig*. 25. muſt be conceived as Analogous to the Line *T S* or *V P* in *Fig*. 24.

The Relation between theſe two Figures being well underſtood, it will follow from what precedes, That the Sum of the Sines of the Meridian Altitudes of the Sun in the two *Tropicks*, (and the like for any two oppoſite Parallels) being multiplied by the Sine of the Semidiurnal Arch, will give an Area Analogous to the Curve Surface *RMSQDP*; and thereto adding in Summer, or Subtracting in Winter, the Product of the length of the Semidiurnal Arch, (taking according to *Van Ceulen*'s Numbers) into the Difference of the above-ſaid Sines of the Meridian Altitudes. The Sum in one Caſe, and Difference in the other, ſhall be as the Aggregate of all the *Sines* of the Sun's Altitude, during his appearance above the *Horizon*; and conſequently of all his *Heat* or Action on the Plain of the *Horizon* in the propoſed Day; and this may alſo be extended to the parts of the ſame Day, for if the aforeſaid Sum of the *Sines* of the Meridian Altitudes, be multiplied by half the Sum of the *Sines* of the Sun's Horary diſtance from Noon, when the times are before and after Noon; or by half their Difference, when both are on the ſame ſide of the Meridian; and thereto in Summer, and therefrom in Winter, be added or ſubtracted, the Product of half the Arch anſwerable to the propoſed interval of time, into the Difference of the *Sines* of Meridian Altitudes, the Sum in one caſe, and Difference in the other, ſhall be Proportional to all the Action of the Sun during that ſpace of time.

I forſee it will be objected, that I take the *Radius* of my Circle on which I erect my Perpendiculars always the ſame, whereas the Parallels of *Declination* are unequal; but to this I anſwer, that our ſaid Circular Baſes ought not to be Analogous to the Parallels, but to the Times of Revolution, which are equal in all of them.

It may perhaps be uſeful to give an Example of the Computation of this Rule, which may ſeem difficult to ſome. Let the *Solſtitial Heat*, in ♋ and ♑, be required at *London*, *Lat*. 51, 32.

38° — 28′	*Co. Lat.*		*Diff. Aſcen.*	33° — 11′
23 — 30	*Decl* ☉		*Arc. Semidi.* Æſtive.	123 — 11.
61 — 58	*Sinus*	=0,882674	*Arc. Semidiur.* Hyb.	56 — 49. *Sin.* 0,836923.
14 — 58	*Sinus*	=0,258257	*Arc.* Æſtiv. *menſura.*	2,149955.
	Summa	1,140931	*Arc.* Hyber. *menſura.*	0,991683.
	Diff.	0,624417		

Then 1, 140931 in, 0,836923 + 0,624417 in 2,149955 = 2,29734.
And 1, 140931 in 0,836929 —— 0,624417 in 0,991638 = 0,33895.

So that 2,29734 will be as the *Tropical* Summer's Day's *Heat*, and 0,33895. as the *Action* of the *Sun* in the Day of the Winter *Solſtice*.

After this manner I computed the following Table, for every tenth Deg. of *Latitude* to the *Æquinoctial* and *Tropical* Sun, by which an Eſtimate may be made of the Intermediate *Degrees*.

Lat.

Lat.	*Sun in* ♈ ♎	*Sun in* ♋	*Sun in* ♑
0	20000	18341	18341
10	19696	20290	15834
20	18794	21737	13166
30	17321	22651	10124
40	15321	23048	6941
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

From this Rule there follow ſeveral *Corollaries* worth Note: As, 1 That the *Æquinoctial Heat*, when the Sun comes Vertical, is as twice the Square of Radius, which may be propoſed as a Standard to compare with in all other Caſes. 2. That under the *Æquinoctial*, the *Heat* is as the Sine of the Sun's Declination. 3. That in the *Frigid Zones*, when the Sun ſets not, the *Heat* is as the Circumference of a Circle into the Sine of the Altitude at 6. And conſequently that in the ſame *Latitude* theſe Aggregates of *Warmth* are as the *Sines* of the Sun's Declinations; and in the ſame Declination of the Sun, they are as the *Sines* of the *Latitudes*; and generally they are as the *Sines* of the *Latitudes* into the *Sines* of Declination. 4. That the *Æquinoctial* Day's *Heat*, is every where as the *Co-ſine* of the *Latitude.* 5. In all places where the Sun ſets, the Difference between the Summer and Winter *Heats*, when the Declinations are contrary, is equal to a Circle into the *Sine* of the Altitude at 6, in the Summer Parallel, and conſequently thoſe Differences are as the *Sines* of *Latitude* into or multiplied by the *Sines* of Declination. 6. From the Table I have added it appears, that the *Tropical* Sun under the *Æquinoctial* has of all others the leaſt Force. And under the *Pole*, it is greater than any other Day's *Heat* whatſoever, being to that of the *Æquinoctial*, as 5 to 4.

Vid. *D.* Wallis, *de Calculo* Centri Gravitatis. *Prop.* 13. *Cap.* 5.

From the Table and theſe *Corollaries* may a general Idea be conceived of the Sum of all the Actions of the *Sun* in the whole Year, and that Part of the *Heat* that ariſes ſimply from the Preſence of the *Sun*, be brought to a *Geometrical* Certainty: And if the like could be performed for *Cold*; which is ſomething elſe than the bare Abſence of the Sun, (as appears by many Inſtances) we might hope to bring what relates to this part of *Meteorology* to a perfect *Theory.*

Accidents by Thunder *and* Lightning, *at* Oxford, *By Dr.* Wallis, n. 13. p. 222.

LIX. 1. *May* 10. 1666. About 5 of the Clock afternoon, the *Thunder* (which I had before heard at ſome diſtance) coming nearer to us, it began to *Rain*, and ſoon after (the Rain withal increaſing) the *Thunder* grew very

Loud, and frequent, and with long ratling *Claps* (tho' not altogether ſo great as I have ſometimes heard :) And the *Lightning* with *Flaſhes* very bright (notwithſtanding the Clear Day-light) and very frequent, (when at the faſteſt, ſcarce a full Minute between one *Flaſh* and another; many times not ſo much, but a ſecond *flaſh* before the *Thunder* of the former was heard:) The *Thunder* for the moſt part began to be heard about 8, or 10 ſecond-Minutes after the *flaſh*; as I obſerved for a great part of the time by my Minute-watch; but once or twice I obſerved it to follow (in a manner) immediately upon it, as it were in the ſame Moment; and the *Lightning* extream *Red* and fiery; ſo that had it been by Night as it was by Day, it would have been very terrible. And though I kept within Doors, yet I ſenſibly diſcover'd a ſtinking *Sulphurous* Smell in the Air. About 7 of the Clock it ended, before which time I had News brought me of a ſad Accident upon the Water at *Medley*, about a Mile or ſomewhat more diſtant from hence. Two Scholars of *Wadham-College* being alone in a Boat (without a Water-man) having newly thruſt off from Shore at *Medley*, to come homewards, ſtanding near the Head of the Boat, were preſently with a ſtroak of *Thunder* or *Lightning*, both ſtruck off out of the Boat into the Water, the one of them ſtark dead, in whom, though preſently taken out of the Water (having been by relation, ſcarce a Minute in it) there was not diſcerned any appearance of Life, Senſe, or Motion: The other was ſtuck faſt in the Mud with his Feet downwards, and his upper parts above Water) like a Poſt, not able to help himſelf out; but, beſides a preſent ſtonying or numbneſs, had no other hurt; but was for the preſent ſo diſturbed in his Senſes, as that he knew not how he came there out of the Boat, nor could remember either *Thundring* or *Lightning* that did effect it: And was very feeble and faint upon it; which, (though preſently put into a warm Bed) he had not throughly recovered by the next Night; and whether ſince he have or no, I know not.

Others in another Boat, about 10 or 20 Yards from theſe (as by their deſcription I eſtimate) felt a diſturbance and ſhaking in their Boat, and one of them had his Chair ſtruck from under him, and thrown upon him, but had no hurt. Thoſe immediately made up to the others, and ſome (leaping into the Water to them,) preſently drew them either into the Boat or on Shore; yet none of them ſaw theſe two fall into the Water (not looking that way) but heard one of them cry out for help preſently upon the ſtroke, and ſmelt a very ſtrange *ſtinking ſmell* in the Air, ſuch as is perceived upon the ſtriking of Flints together.

He that was dead, was the next Morning brought to Town; and Dr. *Willis*, Dr. *Millington*, Dr. *Lower*, and my ſelf, with ſome others, went to view the Corps, where we found no *Wound* at all in Skin, the Face and Neck ſwart and black, but not more than might be ordinary, by the ſetling of the Blood: On the Right ſide of the Neck was a little blackiſh Spot, about an inch long, and about a Quarter of an inch broad at the broadeſt, and was, as if it had been *Sear'd* with a hot Iron; and, as I remember, one ſomewhat bigger on the Left ſide of the Neck, below the Ear. Straight down the Breaſt, but towards to Lift ſide of it, was a large place, about three quarters of a foot in Length, and about two Inches in breadth, in ſome places more, in ſome leſs, which was *Burnt* and Hard, like Leather Burnt with the Fire, of a deep blackiſh Red Colour, not much unlike the ſcorched Skin of a roaſted Pig: And on the fore-part of the Left Shoulder ſuch another Spot about as big as a Shilling; but that in the Neck was blacker, and ſeemed more ſear'd. From the top of the Right Shoulder, ſloping downwards towards that place in his Breaſt, was a narrow Line of the like ſcorched Skin; as if ſomewhat had come in there at the Neck, and had run down to the Beaſt, and there ſpread broader.

The Buttons of his Doublet were moſt of them off; which ſome thought might have been torn off with the *Blaſt*, getting in at the Neck; and then Burſting its way out: For which the greateſt Preſumption was (to me) that, beſides 4 or 5 Buttons wanting towards the bottom of the Breaſt, there were about half a Dozen together clear off, from the bottom of the Collar downwards; and I do not remember, that the reſt of the Bottons did ſeem to be near worn out, but almoſt new. The Collar of his Doublet, juſt over the fore-part of the Left Shoulder, was quite broken aſunder, Cloath and Stiffening, ſtraight downwards, as if cut or chop'd aſunder, by a blunt Tool; only the inward Linen or Fuſtian Lineing of it was whole, by which, and by the view of the ragged Edges, it ſeemed manifeſt to me, that it was by a ſtroak inwards from without, not outwards from within.

His Hat was ſtrangely Torn, not juſt on the Crown, but on the ſide of the Hat, and on the Brim. On the ſide of it was a great Hole, more than to put in ones Fiſt through it: Some part of it being quite ſtruck away, and from thence divers Gaſhes every way, as if torn, or cut with a dull Tool, and ſome of them of a good length, almoſt quite to the Edges of the Brim. And beſides theſe, one or two Gaſhes more, which did not communicate with that Hole in the ſide This alſo I judged by a ſtroak inwards; not ſo much from the view of the Edges of thoſe Gaſhes (from which there was ſcarce any judgement to be made either way) but becauſe the Lineing was not torn, only ript off from the Edge of the Hat (where it was ſow'd on) on that ſide, where the Hole was made. But his Hat not being found upon his Head, but at ſome diſtance from him, it did not appear againſt what part of the Head that Hole was made.

The Night following the three Doctors above mentioned and my ſelf, with ſome Chirurgeons (beſides a multitude of others) were preſent at the opening of the Head, to ſee if any thing could be there diſcover'd; but there appear'd no ſign of *Contuſion*; the *Brain* full and in good order; the *Nerves* whole and ſound; the *Veſſels* of the *Brain* pretty full of Blood. But nothing was by any of them diſcern'd to be at all amiſs. Some of them thought, that they diſcerned a ſmall *Fiſſure* or crack in the *Skull*; and ſome who held it, while it was ſawing off; ſaid they felt it Jarring in their Hands, and there ſeemed to the Eye ſomething like it, but it was ſo ſmall, as that by Candle-light we could not agree it certainly ſo to be.

Some of the *Hair* on the Right Temples was manifeſtly Singed, or Burnt, and the lower part of that Ear blacker than the parts about it, but ſoft, and it might be only the ſettling of the Blood. The upper part of the Left Shoulder, and that ſide of the Neck, were alſo ſomewhat blacker than the reſt of the Body; but weather it were by the Blow, which broke the Collar, and *ſcorched* the round red Spot thereupon, or only by ſettling of the Blood I cannot ſay, yet I think, it might very well be, that both on the Head and on this ſide of the Neck, there might be a very great Blow, and a *Contuſion* upon it, (and ſeems to have been ſo, by the tearing of the Hat, and breaking the Collar, if not alſo cracking of the *Skull*) and yet no ſign of ſuch *Contuſion*, becauſe Dying ſo immediately, there was not time for the Blood to gather to the Part, and Stagnate there, (which in Bruiſes is the cauſe of blackneſs) and it was but as if ſuch a Blow had been given on a Body newly dead, which does not uſe to cauſe ſuch a Symptome of a Bruiſe, after the Blood ceaſes to Circulate.

Having done with the *Head*, they opened the *Breaſt*, and found that *Burning* to reach quite through the *Skin*, which was in thoſe *Scorch'd* places hard and horny, and ſhrunk up, ſo as it was not ſo thick as the ſoft *Skin* about it: But no appearance of any thing deeper than the *Skin*; the Muſcles not at all diſorder'd or diſcolour'd (perhaps, upon the reaſon, that was but now ſaid of the Head, Neck and Shoulder.) Having then taken off the *Sternum*, the *Lungs* and *Heart* appeared all well, and well colour'd, without any Diſorder.

In Hampſhire; By Mr Tho. Neal, n. 14. p. 247

2. *Jan.* 24. $166\frac{5}{7}$. one Mr. *Brooks* of *Hampſhire*, going from *Wincheſter* towards his Houſe near *Andover*, in very bad Weather, was himſelf ſlain by *Lightning*, and the Horſe he rode on, under him. For about a Mile from *Wincheſter* he was found with his Face beaten into the Ground, one Leg in the Stirrup, the other in the Horſe's Mane, his Cloaths all *Burnt* off his Back, not a piece as big as a Handkerchief left intire, and his *Hair* and all his Body *ſinged*: with the force, that ſtruck him down, his Noſe was beaten into his Face, and his Chin into his Breaſt, where was a *Wound* cut almoſt as low as to his Navil. The torn pieces of his Cloaths were ſo ſcatter'd and conſum'd, that not enough to fill the Crown of a Hat could be found. His Gloves were whole, but his Hands in them *Singed* to the Bone. The Hip bone and Shoulder of his Horſe *Burnt* and *Bruiſed*, and his Saddle torn in little pieces. This was what appeared to the *Coroner's Inqueſt*.

At Stralſund *in* Pomerania; *By* . . . n. 65. p. 2084.

3. *Jun.* $\frac{19}{29}$. 1670. (being Sunday) after ſeveral leſs ſtrong reports of *Thunder*. the whole Town, and particularly the Congregation in St. *Nicholas Church*, (when the Miniſter was Preaching) was ſtrangely ſurpriſed with a moſt Terrible Flaſh of *Lightning* and a fearful *Thunder-Clap*, which lighted down through the leſſer Steeple upon the Body of the Church, and through the large round hole in the upper Vault within the ſame, in the ſhape (as ſome obſerv'd) of a black fiery *Ball*, directly upon the Altar, cauſing ſuch an hideous crack, fire flaſh, Smoak, and damp there, as if many Fire-Balls had been thrown down thither from the ſaid Vault, and burſted all at once, begetting a diſmal Conſternation among the People, and leaving an ill *Sulphurous* ſmell behind.

The Candle on the South ſide of the Altar was put out by the Blow, the other remain'd burning. Two of the *Chalices* there were overthrown, and the *Wine* ſpilt, and the *Wafers* ſcatter'd about: But the empty *Chalice* ſtood firm. All three were ſomewhat *ſmutted* at the Foot, and one of them a little bent there, and in two Places pierced thro', as if it had been by Hail-ſhot: and the *Wafer-boxes* were likewiſe a little ſmutted towards the bottom The *Church-Book* was flung on the inner Paſſage: The Covers of the Altar were ſinged in divers parts, as by Powder, and ſomewhat burnt and ſmutted here and there, as alſo torn in ſome places. A ſtrong piece of *Wainſcot* with a Picture upon it, behind the great Altar, was ſplit in two. Of the *Church-Clock*, in the *Weſt-End*, at the ſame time, both the braſs and iron Wires of the Whole and Quarter-hour Hammers, were partly broken, and the reſt could not be found; and an oaken Poſt, fixt in the wall for the ſupport of the Dial was half torn, and beneath the ſame divers Bricks were ſtruck out of the two Head Pillars ſupporting the Steeple. On the Top of the Southern Steeple, an oaken Gutter, and a ſtrong Beam and Supporter were ſhatter'd.

One of the Miniſters, tho ſitting near the Altar to the South, had no Hurt at all. Divers of the People ſeated round about the Altar fell down to the ground with the Fright. One Youth that ſtood next the ſaid Miniſter s Pew, not being able to recover his Senſes, was carried home. On the North ſide of the Altar, four Perſons fell down, and one of the oaken Seats being ſplit under him that ſate thereon, that Perſon was much hurt by it, and more than any other. Some that ſtood in or by the Belfrey, near the Clock, were ſlightly hurt here and there; and among them a Mariner, leaning on a lined oaken Seat there had his right Arm bruiſed; and another Man, tho' but ſlightly hurt, yet could not remember how he got home from Church.

There iſſued forth a huge damp like unto Smoak out of the Southern Steeple, but the *Church-Carpenter* upon ſearch met only with a preſent Noiſe and thick Damp, which tho' it frighted him at firſt into an Apprehenſion of *Fire*, yet getting to the Windows and opening them, the Damp iſſued with great Violence; but there appeared no Fire any where, ſave only a little in the ſhatter'd parts of the Steeple which was ſoon quenched.

The Church-Dial was alſo ſmutted in ſundry Parts, ſoiling the gilt Figures that they could ſcarce be diſcerned. The gilt Weather Cocks upon both the Steeples were likewiſe ſmutted on the one ſide of their Tails, without any other Mark Nor could it be in the leaſt diſcovered in either of the Steeples, which way the Claps entred by all the Search that was made.

It was obſerv'd afterwards, that among the 8 Perſons that were hurt, one who ſtood in the Belfrey, had the upper back part of his Cloth-Coat, as alſo his Shirt and Skin ſomewhat torn; but the Lining of that Coat, which was Red Frieze, had no hurt at all.

Another ſitting betwixt the reſt, in a Pew under the Organs, and leaning on the Door, whilſt the Pew-Lock (then cloſe to his Body) was ſo violently ſtruck out, that it hung only by one Nail, had no Damage at all by it himſelf

ſelf, nor any other that ſate or ſtood by there, when the Stroak happen'd; 'tho' they fell all to the ground by the fright, at the Inſtant when it was given.

And as for him that had his Arm bruiſed, it was ſomewhat ſtrange that afterwards there was found a Hole paſſing his Coat, Waſt-coat and Shirt, on the fore-part of his Body, without in the leaſt hurting the Body; the Hole appearing juſt as ſhot through. His Waſt-coat (being of a red Sarcenet) kept its Colour every where, but at the place where the Arm was hurt: And the ſmall ſilver Edging was ſmutted almoſt every where, and about the Neck too, where the Party wore a Cravat. One half of his Shoe was alſo torn off, the Soal being pierced as with Hail-ſhot: And a piece of his Stocking's Foot on the ſame Foot ſtruck away, near an Hand-breadth, without any other Hurt to either Foot or Leg, but that for ſome days that Foot was benummed.

Laſtly, One of them that ſat by the Altar, had his Breeches and Leather Drawers on both ſides pierced through as by Hail-ſhot, and part of it plainly ſcorcht and ſhrunk up, as by *Fire*: And divers of ſuch ſmall Holes in his Shirt too, yet without any Hurt in his Body; ſave that he found ſome pain in his Foot. One ſide of his Shoe was alſo torn, and the Soal ſidewards pierced thro', as 'twere with Hail-ſhot.

At Dantzick *by* Mr Chr. Kirby, n. 96. p. 6092.

4. About the latter End of *March* and *April*, 1673, we had much and violent *Thunder* and *Lightning*, which had this unhappy Effect upon all the parcels of *Wheat* and *Rye*, of the laſt Years Growth, in our Granaries, that, tho' over-night they were dry, ſweet, and fit for ſhipping, the next Morning they were become clammy and ſtinking; ſo that the *Owners*, if they would not loſe their Grain, were forced to cauſe it to be turned over two or three times a Day; and yet it required ſix Weeks, if not longer, before it was recovered. This is a thing which often happens to Corn that hath not lain in the Granary a whole Year, or not ſweat throughly in the Straw, before it be thraſh'd out.

At Portſmouth, *By* n. 177. p. 1212.

5. *Octob.* 23. 1685. On board the *Royal James*, a Flaſh of *Lightning* and *Thunder* together took the Maſt, which was put into her for careening, being a made Maſt, and bound with iron Hoops from one end to the other, and ſhiver'd it down to the Deck, breaking one of the iron Hoops in the Body of the Maſt, ſo that Splinters are forc'd out of the middle of the Maſt a Foot and half long, (and a *Ball* of *Fire* to run to and fro on the Deck) inſomuch that the Maſt is wholly unſerviceable, and muſt be taken out.

On board the *Coronation*, notwithſtanding the Ships head was to windward, a great *Ball* of *Fire* came into the Gun-room Ports, and threw a Boy out of one of the Ports, and he was drowned; and ſeveral Work-men being on board, as Carpenters, Joyners, and Seamen were ſtruck down and made ſenſeleſs for ſome time, and the *Ball* of *Fire* ran up and ſtruck on the Starboard-ſide of the Wardrobe, and left a place ſcorched round upon the ſide, and between the two Ring-bolts, as if it had been a Shot, and beat the Wainſcot over to the ſide, all ſcorcht as if with Fire; and run up againſt the Doors and Hinges, away, and run into ſeveral *Balls* of *Fire* on the Deck amongſt the Men; and ſome part of it broke in at the Windows of the Round-houſe, and ſhivered off a great deal of the Wainſcot, and broke the Glaſſes of the *Perſpective-Glaſs*, and made a *Hole* thro' a Letter that lay in the Window eight double, the Circumference of a Musket-Bullet, and no more; it alſo ſhivered the Timber that holds the *Enſign-Staff* on the *Poop*.

6. *Mar.* 20. 169$\frac{2}{3}$ about 8 at Night there aroſe a very violent Guſt of Wind at South-weſt, which laſted an Hour and an half, during which time, it rain'd very faſt. A quarter of an hour or thereabout after Nine, fell a mighty Storm of Hail intermixt with Rain, which lay very white, and ſome depth on the ground, and to me appeared to have Snow mixed with it. During that Storm happen'd 2 *Flaſhes of Lightning*, very violent and ſtrange; it was extraordinary blew, and of a ſulphurous Smell; it ſeemed to ſtand ſtill in the houſe ſome conſiderable time, and was ſo great that a Gentleman who ſate below Stairs, thought that the Houſe had been on *Fire* above, and that the Flames rolled down Stairs; the Clap of *Thunder*, which immediately followed, ſeemed to all like the ſudden Diſcharge of 5 or 6 Field-pieces; not with that rolling deep Noiſe *Thunder* uſually carries along with it. The ſecond *Flaſh* and *Clap* followed within a few Minutes of the firſt, but not with that Violence as the former: Which Flaſh fired the Steeple I cannot ſay, but a piece of Wood to which the Lead of the Windows was nailed was ſet on Fire, and kindled very faſt, and might have done a great deal of Miſchief, had not the Earlineſs of the Night and timely Help prevented it. This Storm ſeemed to run in a direct Courſe; for ſeveral of our ſide Towns perceived little of it; and I believe it broke chiefly over us. At *Kettering*, one of their Bells, as ſome ſay, received ſome Damage, and the Wires of the Chimes were twiſted one with another. The Wind was very bluſtering all the Night after.

At Oundle, by Mr. Vi[illegible].

7. *Aug.* 13. 1693. about 3 a Clock in the Morning, it began to thunder and lighten, and rain; about 4 a Clock came a Clap of *Thunder* and *Lightning* all at the ſame Moment of Time, that was ſo ſmart and violent, that I thought the Ship had been ſplit in pieces; an Alarm went preſently thro' the Ship, of *Fire*, *Fire* the dreadfulleſt Word that can happen on board, and put us all into Confuſion. But it happen'd to rain briskly about that time and ſo with the help of our Buckets, the Fire which was occaſioned by the *Balls* of *Lightning* that came between Decks, was ſoon put out. In the *Gangway* was one Man knock'd down, and lay ſometime before he recovered himſelf; a ſecond near him was blown almoſt the Length of the Quarter-deck; a third was burnt all down his Back with the *Lightning* in his Hammock. Our *Main Top-Gallant-Maſt* was ſplit in pieces our *Top-maſt* not touched; our *Main Maſt* ſplit from the Top down to the very Deck.

On Board the Suffolk *in the Bay of* Biſcay; *Dr.* Oliver, n. 204. p. 911.

8 *Jul.* 24. 1696. We had an extraordinary pleaſant Fore-noon, with continual Sun-ſhine till about half an hour after three in the Afternoon, when we had ſome Rain, after which happened two *Claps* of *Thunder*, though not very great, and then a great Shower of *Hail*, in which time happen'd a third *Clap* which made all our Loſs. We were 16 in Number, none of us hapning to be out or abſent at the time, The moſt part of them were ſtanding

Near Aberdeen *in* Scotland; *by* [illegible] n. 222. p. 311.

about me in the School, hard by my Chamber-door; the 2 foreſaid Claps of *Thunder* being over, we thinking nothing of them; and now there being a great Shower of *Hail*, on a ſudden there happened ſuch a *Flaſh* of *Lightning* which I ſaw, and as I thought fill'd the whole houſe, but of the *Clap* I minded nothing, but only I think that I heard as it were ſome ſharp Clink or Sound, but our Neighbours in the Town ſuch as the Miniſter and his Wife, told, they never heard a louder: But however, I think all our loſs was by the *Fire*, which was over in an Inſtant, and after which we had darkneſs in the *School*, by reaſon of the *Smoke*, with a moſt violent ſulphurous Smell, and the burning of ſome Leaves of Books. There are 5 Breaches in the Walls, one in the Roof, exactly in Shape like a Cannon-ball; another under the Chimney, a third came thro' the back Wall, and quite thro' the other Wall oppoſite to it; and the Chimney was ſplit in pieces, and ſome that came to the School Door, and made a Breach there, renting the Stones in pieces, and carrying them out. There were 4 kill'd, and many of the reſt hurt, having their Legs or Arms ruined; but are all, I thank God, recovered. And as for my ſelf, I never was in greater Danger, for there was one killed before me, another at my left hand, and not half a Foot from me there was a Breach made in the middle Wall of my Chamber, and yet I thank God I received no Hurt, only I was bled in the Mouth, but how I cannot tell. As to the Childrens Bodies that were kill'd, I found none of their Bones broken; my Brother had a Cut in his Head; and all of them, where they received the Strokes, had their Cloaths cut, as if it had been eat out with Rats; they all received their Strokes on their vital Parts, as about their Shoulders, which were in Colour of a browniſh black. All the Children that were killed, were in different Places, and as it were, pick'd out.

At Smyrna, by Mr. R Mawgridge, n. 235. p. 782.

9. *Nov.* 26. 1696. A ſad and aſtoniſhing Accident happened to the *Trumbull Galley* by *Lightning* and *Thunder*. For as we lay at Anchor at *Smyrna*, about one of the Clock in the Morning, ſhe was ſtaved in ſeveral places; the *Bulk-head* of her *Round-houſe* was ſtaved all to pieces into the Captain's Cabbin, and hurt his Shoulder, her *Mizen-Maſt* was ſtaved all to pieces, and the *Spindle* in the Head of the Maſt was melted at both Ends with the *Lightning*; the *Main-Top Sail-Yard* was laſhed in the Top, yet notwithſtanding the *Yard* was thrown out, and ſtuck in our *Awning* right an End. The Quarter-Maſter (one *John Page*) was on the Deck by the *Mizen-Maſt*, and one *John Allen*, who were both ſtruck down flat thereon with the *Lightning*. *Page* had one ſide of him ſtupified for three Days but under God, I recovered him in ſix Days; *Allen* was very well the next Day when his Fright was over. The *Lightning* did ſtrike the Plank for 6 Foot off of the outſide of the Galley all to pieces, and the Timber was like a Bruſh, and three Planks of the Cieling was ſtarted, whereof 2 Foot and 7 Inches was ſtaved out from the reſt, within 10 inches of my Head; my velvet Cap was hanging on a Nail in the ſame piece of Cieling, the inſide whereof, next unto the *Lightning*, had not one ſtitch amiſs but the Outſide had all the Seams burſt to pieces: A great weighty Nail was ſtarted out of the ſaid Cieling, and fell over my Head, and lay upon my Pillow, and I thought my Head with the

Lightning had been in a Flaſh of Fire. Whilſt I could but juſt ſhut my Eyes and open them again, the *Lightning* went down into the Hold, and ran out like a Train of *Wild-fire*, and burſt out through the Gally's ſide, and rent 10 or 11 Foot of the outſide Plank off, within a Foot of the Water's Edge. Some of the *Lightning* ſhot up between the Timbers and the Ceiling into the Gun-Room, and ſtaved a Beam, and ſet 3 or 4 Bundles of armed Match all on Fire. The Gunner, *George Hardy*, was lying in his Cabin at the ſame time, and the *Lightning* bliſtred one of his Feet, and ſing'd his Hair of his Head. The Maſter's Cabbin was Between the Gunner's and mine, but had no Damage.

10. *July* 27, 1691. in *Everdon* Field, near *Daventry* in *Northamptonſhire*, divers were at work reaping Corn. The Morning was fair and clear, but before Noon there came a violent Storm of *Thunder* and *Lightning* and *Rain*, which cauſed the Reapers, about 20 in all, to retreat for Shelter to a *Quickſet Hedge*, with a Ditch by the Side of it. Of theſe Perſons 4 were kill'd, *viz. Simon Marriot*, *Rob. Marriot*, *Rich. Wells* and *Thomas Burroughs*, and 8 others dangerouſly hurt, of the reſt ſeveral were ſtruck down, but not much hurt.

In Northamptonſhire, by *Dr.* Wallis, p. 236 p. 5:

Upon the firſt Tidings of this Accident, Mr. *Edwards* (the Miniſter of *Badby*) repaired to the Place: where *Robert Marriot* lay on his Back out of the Ditch, having ſtruggled (as was ſaid by the By-ſtanders) after the Stroke. Mr. *Edwards* ſays, he ſaw no Marks or Sign of hurt on the Body: But the Woman who laid out him and the reſt ſays, there was a *Hole* about the Bigneſs of a Gooſe-ſhot in the Pit of his Stomach, and many more about his Legs. There was in the Hedge a Pollard-Aſh, under which ſat *Simon Marriot* and *Richard Wells*; but *Thomas Burroughs* ſat at the Diſtance of two or three Yards from thence. In this Tree were cut or raiſed four (or more) Groves or Furrows, from the Top to near the Bottom, deeper than the Bark, and about an Inch brood each of them, on that ſide of the Tree on which the Men ſat; but no Damage appeared on the Tree elſewhere, there being a Knot on the oppoſite Side, which is ſuppoſed to have diverted the Stream of the fiery Matter. The green *Thorns* were ſcorched, and the Place ſmelt rank of *Sulphur*.

Simon Marriot had the Crown of his Hat cut into the Shape of a bearded Arrow, and at the Band-place cut ſmooth, almoſt round about from the Brim. His Cloaths on one Shoulder cut jaggedly to the Skin, where was a Scar about 4 Inches in length, of a long oval Figure, the tranſverſe Diameter whereof was deepeſt, of a darkiſh red Colour, as hard as *Horn* all over. He had Snuſh on his Hand, as if juſt ready to take it.

Richard Wells had a little Dog on his Lap, or between his Legs, dead. His Hand upon the Dog's Head his Eyes open, and with Bread and Cheeſe (or one of them) in his Hand, as if going to give the Dog a bit His Shoulder (as his Relations ſay) was ſtruck down, and in a Manner ſevered from his Body.

Thomas Burroughs ſat as looking up to the Heavens, his Head turning toward one ſide, as viewing the Clouds, his Eyes open. He had in his Pocket a Copper Tobacco-box, which had one little round Hole ſtruck quite thro' it; and a little of the Metal on one Side ſeemed to have run. By theſe Poſtures it is evident they died in a Moment.

Mr. *Edwards* adds, that he took *Simon Marriot*'s Hat, and ſome of his Cloaths, and held them againſt the Light and they appeared full of Holes, as a Skimmer or Cullender. But (at which he wondred moſt) the Woman who laid them out told him, their Buttocks which ſat upon the Ground were pitifully mangled, and their Privy-Members rent and torn and pieces; and more eſpecially thoſe of *Thomas Burroughs*, as if ſmall Bars of red hot Iron had been thruſt up into them in many Places.

The Hair of their Heads were burnt very much. Some had no Harm that were hard by: But others were wounded at a Diſtance, and their Wounds were cured with more Difficulty than ordinary Burns.

It was (before the Storm) a pretty ſtill Day. But before each *Thunder-Clap*, was heard a great Whirling Noiſe in the Trees like Wind. The *Lightning* was obſerved by Perſons at a Diſtance, all falling perpendicularly upon them. Thoſe who recovered had their Cloaths full of Holes, as if they had been ſhot through. Not a Drop of Blood appeared upon any of them. Their hurts like dry, ſcorched, ſcarred or healed Wounds.

Simon Marriot, and *Robert Marriot* were ſtruck back, the other two, ſupported as is ſuppoſed, by the Hedge at their Back) continued in the Poſture wherein they were kill'd, three or four Hours after, when Mr. *Richard Butler* of *Preſton* ſaw them.

Several of thoſe who were hurt, were taken up for dead, but ſoon came to themſelves without any Application: But ſome of them were fain to be carried home.

Will. Gregory's Wife had 4 little Holes in her Knee, like Shot-holes, which turned to Sores, and had Cores came out of them.

Mary Bird (a Woman with Child) had all over her Body near an hundred *Wounds*, ſome as large as a Man's Hand, on each Arm one, and one on each ſide of her Belly. Out of moſt of her Wounds came *Cores*, ſome bigger, ſome leſs; the biggeſt were bigger than a walnut, dry and black like Leather. She had two Sores on the Soles of her Feet, but her Shoes and Stockings not touched. She ſate next to thoſe that were kill'd, ſhe was taken out of the Ditch for dead, and was ſuppos'd to be kill'd. She was ſenſible of the Stroke, and ſenſible that her Husband look'd pale, and then ſwooned away. She and her Husband were both blooded, ſhe within an hour after and her Husband 8 Hours after; and they bled freely. Their Legs were mightily ſwell'd, before they were carried out of the Field. The Woman was very ſore and full of Pain, ſo that ſhe could hardly bear any Cloaths to touch her. She was three Weeks ill before ſhe could riſe, and continued ill about a Quarter of a Year. No Medicines uſed for Burns did any good, but occaſioned great Torment to her. The firſt that they perceived to do good wa Oil of St. *John's-wort*, and after the Cores were come out, the *Black-Salve* She went out her full Time: The Child had no Marks or Blemiſh at al

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upon this Occaſion; and is yet living. About that Time of the Year, ſhe hath been blooded ever ſince. She finds a great Tingling, and hath little Pimples like Stinging of Nettles, and cannot be well until ſhe hath been blooded.

The Wounds of all thoſe that were hurt, were like thoſe of this Woman, but ſlighter; and ſome of them had no Cores came out of them.

This is the beſt Account I can give you out of the broken Remarks which I had in Writing from Mr. *Edwards*, and Mr. *Butler*, the two Gentlemen above mentioned.

11. *Dec.* 22. 1698. *Jeremiah Skelton*, at *Warley*, in the Vicaridge of *Halifax* in *Yorkſhire*, obſerving a Storm coming upon him, ſtep'd aſide for Shelter within a Barn-Door, and while there, was ſtruck with a dreadful *Flaſh* of *Fire*; a young Woman that lived with her Father, in the Houſe that belonged to this Farm, being ſadly affrighted with the *Thunder* and *Lightning*, (for part of the ſulphurous Matter came down the Chimney, and filled the Houſe with a ſtrong Scent, like that of Gun-powder after firing) ſhe leaves the Houſe, and not ſeeing the young Man about the Barn, goes with ſpeed and tells the Family he was related to, that ſhe fear'd he was ſlain. They came to the Bran and found it even ſo: A ſad Spectacle; the young Man caſt down and many Stones about him, he was laid upon his Face, wholly naked ſave a ſmall part of his Shirt about his Neck, and a very little of a Stocking upon one Foot, and ſo much of a Coat-Sleve as covered the Wriſt of one Arm; his Clogs driven from his Feet, one not to be found, and the other cloven, his Hat not to be found after Search; and the reſt of his Garments torn into ſmall Shreds, and caſt at conſiderable Diſtances one bit from another; the *Hair* of his *Head* and *Beard* ſinged, as tho' it had been with a Candle, and a little hole below his left Eye, which they ſuppoſed might be made with the Fall upon a Stone: for there was a great Breach made upon the Barn, the Door-tops, both of Stone, broken, and the Wall above them fallen, with the Slate and Water Tables.

In Yorkſhire, 1698; *By* Mr. Ral. Thoresby, n. 249. p. 51.

12. *Apr.* 27. 1700. We had (at *Leeds* in *Yorkſhire*) a pretty ſevere Storm of *Thunder* and Lightning; one Clap particularly was very loud, and ſeem'd to me to be very low and near us. It fell upon a Cottage and broke down part of the Chamber Chimney, and thence made its way thro' a Chink or Nick in the Floor to the lower Room, whereby the Flame thus contracted was either more intenſly hot, or at leaſt directed more immediately to a Shelf where it melted ſeveral holes in two Pewter Diſhes; it melted alſo, and run into little Lumps, ſeveral Places in a pewter Candleſtick, and of a braſs Mortar, yet burnt not ſome bits of Fringe, and other combuſtible Matters within it; it burnt alſo ſome holes in a Tinn Veſſel, and ſmutted a white ſtone Plate it ſtood upon, as if it had been with *Lamp-black*, and filled the Room with ſuch a *Bituminous Smell*, (like fired Gunpowder) as almoſt ſtifled the poor Woman, who was all alone in the Houſe: But upon opening the Door, received no farther Damage. I bought the Candleſticks to preſerve as a Memorial of ſo uncommon an Accident.

In Yorkſhire, 1700; by Mr. R. Thoresby, n. 264. p. 577.

I

I have enquired of one in that Neighbourhood concerning a more fatal Accident, of which the *Pariſh-Regiſter* has this Note. *Sept.* 2. 1672. was buried *Thomas*, the Son of *James Lambert Junior*, deceas'd, of *Holbeek*, Slain the Day before, being the Lord's Day, by a *Thunderbolt*. His Skin, as I am informed, was perfectly burnt black, and was ſhrunk up hard like Parchment, or Leather burnt with Fire. There were other Children in Company, who were alſo caſt down by the Storm, amongſt whom the Party I ſpoke to had a Brother and Siſter; he had a pair of new Stockings burnt off his Legs, and himſelf was ſo ſcorched, that he never recovered his natural Complexion: She having a Waſte coat claſped before (as the Faſhion then was) was ſo burnt betwixt her Breaſts, that the Scars thereof remain to this Day: Another had the ſtiffned Neck of his Doublet ſtruck off.

But all recovered except *Lambert*'s Boy, who was found with his Face upwards, whereas all the reſt had theirs to the Earth: Which reminds me of our Coal-Miners Practice, who when any ſwoon away by their ſulphurous Damps Dig a *Hole* in the Earth, and lay 'em on their Bellies, with their Mouths in it, which, if it prove not an abſolute Suffocation, recovers them.

The Direction of Ship Compaſſes changed with Thunder and Lightning, by n. 127. p. 647.

LX. 1. Mr. *Haward*, who has been Maſter of ſeveral Ships, and is a Man of good Credit, tells me, That in a Voyage to *Barbadoes*, in Company of another Ship commanded by one *Groſton* of *New-England*, they were, in the *Latitude*, as I remember, of *Bermuda*, ſuddenly alarmed with a terrible *Clap* of *Thunder*, which broke this *Groſton*'s Fore maſt, tore his Sails, and did ſome Damage to his Rigging: But by that Time the Noiſe, together with the danger of this frightful Accident was paſt, Mr. *Haward*, to whom this *Thunder* had been more favourable, was however no leſs ſurprized, to ſee his Companion's Ship ſteer directly homeward again. When they were almoſt out of Call, he tack'd and ſtood after them, and found, That Mr. *Groſton* did indeed ſteer by the right Point of his Compaſs, but that the Card was turn'd round, the North and South Points having changed Poſitions, and though with his Finger he brought the *Flower de Lys* to point directly North, it would immediately as ſoon as at Liberty, return to this new unuſual Poſture, and upon Examination, he found every Compaſs in the Ship of the ſame Humour: Which ſtrange and ſudden Accident he could impute to nothing elſe but to the Operation of the *Lightning* and *Thunder* newly mentioned. He adds, that he lent *Groſton* one of his Compaſſes to finiſh the Voyage, and withal that thoſe *Thunder-ſtrucken* ones, did never to his Knowledge recover their right *Poſitions* again.

By Sir R. S. n. 157. p. 520.

2. *July* 24, 1681. The Ship called the *Albemarle*, whereof Mr. *Edward Lad* was then Maſter, being a hundred Leagues from *Cape Cod*, in Lat. 48^{d}. about 3 h. *p. m.* met with a *Thunder-ſtorm*, the *Lightning* burnt the Main-Top-Sail, ſplit the Main Cap in pieces, rent the Maſt all along, there was in ſpecial one dreadful Clap of Thunder, in report bigger than that of a great Gun, at which all the Ship's Company were amazed; then did there fall ſomething from the Clouds upon the Stern of the Boat, which broke in to

many ſmall parts, ſplit one of the Pumps, the other Pump much hurt alſo; It was a Bituminous matter, *Smelling* much like fired Gun Powder: It continued burning in the ſtern of the Boat; they did with Sticks diſſipate it, and poured much Water on it, and yet they were not able by all that they could do, to extinguiſh it until ſuch time as all the matter was conſum'd.

When Night came, obſerving the Stars, they perceived that their *Compaſſes* were *Changed*; as for the *Compaſſes* in the *Bittakle*, the *North-Point* was turned clear *South*. There were 2 other *Compaſſes* unhung in the Locker in the Cabbin, in one of which the *North* Point ſtood *South*, like that in the *Bittakle*; as for the other, the *North* Point ſtood *Weſt*; ſo that they ſailed 1000 Leagues by a Needle, whoſe *Polarity* was quite *Changed*. As for the *Compaſs* wherein the *Lightning* had made the Needle to Point *Weſtward*, ſince it was brought to *New-England*, the Glaſs being broken, it has, by means of the Air's coming to it, wholly loſt its Virtue.

Mr. *Edward Randolph* (who has been 4 times imployed to *New-England* in his Majeſty's Service) being enjoyned by Mr. *Flamſteed* to make enquiry into this matter, at his return to *Boſton* in *Dec.* 1683. ſpoke with Mr. *Lad* himſelf. He affirmed the ſame thing, and dictated to him an account ſuitable to what you have. But that which you have, was in the hands of Mr. *Mather* a Miniſter, to whom Mr. *Lad* had alſo preſented one of the *Compaſſes*, as he had done the other to an *Engliſh Merchant* in *Amſterdam*, who gave it to the State-houſe.

A Fiery Exhalation or Damp, by Mr. Maurice Jones, n. 238. p. 49.

LXI. 1. About *Chriſtmaſs* 1693. at *Harlech* in *Merionydh-ſhire*. 16 Ricks of Hay and 2 Barns, whereof one was full of Corn, the other of Hay, were ſet on Fire by a *Kindled Exhalation*, which was often ſeen to come from the Sea, and laſted at leaſt a Fortnight or three Weeks; and it annoyed the Country as well by *Poyſoning* their Graſs, as *Firing* the Hay, for the ſpace of a Mile, or thereabouts. Such as have ſeen the Fire, ſay it was a blew weak Flame, eaſily extinguiſhed, and that it did not the leaſt harm to any of the Men, who interpoſed their Endeavours to ſave the *Hay*, though they ventured (perceiving it different from common Fire) not only cloſe to it, but ſometimes into it. All the Damage ſuſtained happen'd conſtantly in the Night. *Dec.* 24. *Richard Griffith* of *Lechwedh-du*; *Humphrey Owen* of *Garreg-wenn* and *Richard Davydh* of *Erw-wenn*, each of them loſt a Rick of *Hay*. 27. That Night was burnt one Rick of *Hay* of *John Philips* of *Ynyſlanvihangel y Traithau*, two Ricks of *Hay* of *Griffith John Owen* of *Ceſn-Trevorbach*, and *Katharine William*, Widow, of *Ceſn Trevor fvawr*, loſt 2 Ricks. 2. That Night *Francis Evans* of *Glaſs-vryn* had one Rick burnt. *Richard Davydh* of *Erw-wenn* had a Barn full of *Hay* of 3 Bayles of Buildings, burnt down to the Ground.

There are 3 ſmall Tenements in the ſame Neighbourhood (call'd *Tydhin-Sion Wyn*) whereof the Graſs is ſo *Infected*, that it abſolutely kills all manner of Cattle that feed upon it. The Graſs has been *Infectious* theſe three Years, but not throughly Fatal till this laſt.

2. An

By Mr. Edw. Lhawyd, n. 213. p. 223.

2. An Intelligent Sober Perſon that lives near *Harlech*, aſſures me that the *Fire* ſtill [*Aug.* 1694] continues there; that it is obſerved to come from a place call'd *Morva bychan* in *Caernarvonſhire*, about 8 or 9 Miles off [over part of the Sea.] That Cattle of all ſorts, as Sheep, Goats, Hogs, Cows, and Horſes, ſtill *die* apace; and that for certain any great Noiſe, as Winding of Horns, Drums, *&c.* does *Repel* it from any Houſe or Barn, or Stocks of *Hay*, upon account of which Remedy, they have had few or no Loſſes ſince *Chriſtmaſs*: That it happened, during this Summer, at leaſt one Night in a Week, and that commonly either *Saturday* or *Sunday*; but that now of late it appears ſomething oftner. The place from whence it proceeds is both Sandy and Marſhy.

Fairy Circles, by Mr. Jeſſop, n. 117. p. 394.

LXII. I have often been puzled to give an Account of thoſe *Phænomena*, which are commonly called *Fairy-Circles*. I have ſeen many of them, and thoſe of two ſorts; one ſort *Bare*, of 7 or 8 Yards Diameter, making a Round path ſomething more than a Foot broad, with Green Graſs in the middle; the others like them, but of ſeveral bigneſſes, and encompaſſed with a Circumference of Graſs, about the ſame breadth, much *Freſher* and *Greener* than that in the middle. But my worthy Friend Mr. *Walker*, gave me full Satisfaction from his own Experience; it was his chance one Day, to walk out among ſome Mowing Graſs (in which he had been but a little while before,) after a great Storm of *Thunder* and *Lightning*, which ſeemed by the Noiſe and Flaſhes to have been very near him: He preſently obſerved a *Round Circle*, of about 4 or 5 yards Diameter, the Rim whereof was about a Foot broad, newly *Burnt Bare*, as the colour and brittleneſs of the Graſs Roots did plainly Teſtifie. He knew not what to aſcribe it unto but the *Lightning*, which, beſides the odd *Capricios* remarkable in that Fire in particular, might without any wonder, like all other Fires, move round, and burn more in the Extremities than the middle. After the Graſs was Mowed, the next Year it came up more *Freſh* and *Green* in the place burnt, than in the middle, and at Mowing-time was much taller and ranker.

The Cauſe *of* Lightning *and* Thunder *conſider'd by Dr.* Liſter, n. 157. p. 517.

LXIII. 1. There are two ſorts of Inſtances (that often occur in Hiſtroy) which very much favour my Opinion, That *Thunder* and *Lightning* owe their Matter from the ſole *Breach* of the *Pyrites*.

The firſt ſort of them are thoſe which tell us that in *Italy* it rained Iron in ſuch a Year, and in *Germany* a great body of Iron-ſtone fell at ſuch a time; the like *Avicen* affirms. *Julius Scaliger* ſays that he had by him a piece of Iron which was rained in *Savoy*, where it fell in divers places. *Cardan* reports 1200 Stones to have fallen from Heaven, and one of them weighed 120 *l.* ſome of them 30 *l.* ſome 40 *l.* very Hard, and of the Colour of Iron. Now that which is very remarkable (ſays *Gilbert*, where thoſe inſtances are reckon'd up,) and a very probable Argument for the Truth of ſuch like Inſtances, is that it is no where recorded, that it ever rained Gold or Silver Ore, or Tin, or Lead; but Copper hath been alſo ſaid to have fallen from the Clouds.

But whereever the *Pyrites* is mentioned by the Antients, it is always to be underſtood of the *Copper Pyrites*; they ſcarce having had any Knowledge of the *Iron-Pyrites*. And therefore the raining of Copper makes it yet more probable, becauſe of its great Affinity with Iron.

Now this *Ferrum* or *Æs Nubigenum*, if there was ever any ſuch, was concreted of the *Breath* of the *Pyrites*, which we have elſewhere ſhewn to be the *Pyrites*, *ex tota Subſtantia*.

The other Inſtance, (which is owing to our Regiſters) is of *Lightning* being *Magnetick*. This I am ſure of, I have a Petrified piece of Aſh, which is *Magnetick*; that is, the *Pyrites in Succo*; which makes it probable it may be *Magnetick* alſo in Vapour.

Vid. Sup. §. LX.

2. *Thunder* and *Lightning* are ſo very like the Effects of fired *Gun-powder*, that we may reaſonably judge them to proceed from like *Cauſes*. Now the Principal Ingredients in Gun-powder are *Nitre* and *Sulphur* (the Admiſtion of Char-coal being chiefly to keep the parts ſeparate, for the better Kindling of it.) So that if we ſuppoſe in the Air, a convenient Mixture of *Nitrous* and *Sulphurous* Vapours, and thoſe by Accident to take Fire, ſuch *Exploſion* may well follow, with ſuch Noſe and Light, as in the firing of *Gun-powder*. And being once kindled it will run from place to place, as the Vapour leads it, as in a Train of *Gun powder*, with like Effects.

The Cauſe of Hail, Lightning *and* Thunder *conſidered, by Dr.* Wallis, n. 231. p. 655.

This *Exploſion*, if high in the Air, and far from us, will do no Miſchief, or not conſiderable; like a parcel of *Gun-powder* fired in the open Air, where is nothing near to be hurt by it: But if near to us (or amongſt us) it may kill Men or Cattle, Tear Trees, fire *Gun-powder*, break Houſes, or the like; as *Gun-powder* would do in like Circumſtances. This Nearneſs or Farneſs may be eſtimated by the diſtance of time between ſeeing the *Flaſh* of *Lightning*, and hearing the Noiſe of the *Thunder*. For though in their Generation, they be Simultaneous; yet (*Light* moving faſter than *Sound*) they come to us ſucceſſively. I have obſerved that commonly, the noiſe is about 7 or 8 *Seconds* after the *Flaſh* (that is, about half a Quarter of a Minute;) but ſometimes much ſooner, in a *Second* or two, or leſs than ſo, and almoſt immediately upon the *Flaſh*. And at ſuch time, the *Exploſion* muſt needs be very near us, or even amongſt us. And, in ſuch Caſes, I have (more than once) Preſaged the Expectation of *Miſchief*, and it hath proved accordingly.

Now, That there is in *Lightning* a *Sulphurous Vapour*, is manifeſt from the *Sulphupous Smell* which attends it, and a Sultry heat in the Air which is commonly a Fore-runner of *Lightning* ſoon after. And that there is alſo a *Nitrous Vapour* with it, we may reaſonably judge, becauſe we do not know of any Body ſo liable to a ſudden and violent *Exploſion*.

As to the *Kindling* of theſe Materials, in order to ſuch *Exploſion*, I am told that a Mixture of *Sulphur* and *Filings* of *Steel*, with the Admiſtion of a *little Water*, will not only cauſe a great Effervescence, but will of it ſelf break forth into an actual Fire. I ſay a *little Water*, becauſe too much will hinder the Operation, or quench the Fire, which I take to be the *Cauſe* of the *Bath Waters*,

n. 233. p. 29.

Waters, and other *Hot Springs*, where *Steel* and *Sulphur* cauſe a great Effervеſcence, but no Flame.

n 231. p. 657. So that there wants only ſome *Chalybeat* or *Vitriolick Vapour* (or ſomewhat *Equivalent*) to produce the whole Effect (there being no want of Aqueous Matter in the Clouds.) And there is no doubt, but that amongſt the various *Effluvia* from the Earth, there may be copious Supplies of Matter for ſuch Mixtions.

n. 233. p. 730. The ſame Account may be alſo given of *Ætna* (and other *Burning-Mountains*;) where the Mixture of *Steel* and *Sulphur* may give a *Flame*; which is oft attended with prodigious *Exploſions* (and *Earthquakes*) from great Quantities of *Nitre*, as in Springing a Mine.

This may alſo ſuggeſt ſomewhat as to the *Generation* of *Hail*, which is very oft an attendant of *Thunder* and *Lightning*. 'Tis well known, in our Artificial *Congelations*, that a Mixture of *Snow* and *Nitre* (or even common Salt) will cauſe a preſent and very ſudden *Congelation* of *Water*. And the ſame in Clouds may Cauſe that of *Hail-ſtones*. And the rather, becauſe there ſeems ſomewhat like *Snow* rather than *Ice*, in the midſt of them. And as to thoſe in particular ſo very large (as to weigh half a Pound, or three Quarters of a Pound) ſuppoſing them to fall from ſo great a height, as 'tis manifeſt they did by the violence of their Fall: 'Tis very poſſible, that, though their firſt Concretion, upon their ſudden *Congelation*, might be but moderately great as in other *Hail*, yet in their long Deſcent, if the Medium through which they fall were alike inclined to *Congelation*, they might receive a great Acceſſion to their Bulk, and divers of them Incorporate into one. Like as in that ſtrange Shower of *Hail* in *December*, 1672. wherein there did hang on the Trees a great deal in the Form of *Icicles* a Foot or more in Length.

Vid. Sup. § XLIV.

Vid. Sup. § LI.

n. 236. p. 9. Vid. Sup. § LII. 10. Theſe Conſiderations may alſo furniſh us with ſome account of the *Natural Cauſes* of thoſe particular Circumſtances, which attended the Accident at *Everdon* where 4 Perſons were kill'd, and others hurt with *Lightning*.

It ſeems to me that in and over the Ditch there was plenty of ſome *Cauſtick Vapour*, of a like Nature with the Ingredients of *Gun-powder*: And perhaps even under thoſe who were killed or wounded. And if this *Exploſive* Quality were attended with that of *Glaciation*, as *Thunder* is often accompanied with *Hail* (*Nitre* being a proper Efficient of both,) there might be ſuch Concretions, in the Nature of *Hail*, as might (by ſuch *Exploſion*) be ſcattered like *Hail-ſhot* out of a Gun, and cauſe ſuch *Holes* as are ſaid to have been in the Cloaths and Fleſh of thoſe Perſons. And what is ſaid to have been obſerved by others at a diſtance, like a *Ball* of *Fire* falling down directly upon the Place, might be a Propagation of the *Flame* kindled above, and continued, as the *Vapour* directed it, to the Place (as would be in a Train of *Gun-powder*) and might there hurt ſome and ſpare others, according as it was here or there more Copious. For we are not to preſume that it was in all places equally mixed.

The *Cores* which came out of the Wounds, ſeem like *Eſcars* made by a

Clauſtick

Cauſtick or other Burnings. And I take them to be ſcorched Skin, mortified, (beat into the Fleſh by that *Hail-Shot*) and appearing like burnt Leather: Which muſt be worked out before the Wound could be healed; as is uſual, when other Heterogeneous Matter is forced into the Fleſh.

That ſome of the People not far off, might be thrown down, and not otherwiſe conſiderably Hurt, is not ſtrange; who might be within the *Blaſt*, though not within the reach of the Fire; as we ſee in the *Exploſion* of *Gun-powder* (to which I take this to be very like) when Windows (and other things at a diſtance) are ſhaken and ſhatter'd by the *Blaſt*, or great Concuſſion of the Air, though the *Flame* do not reach them.

Halo's, at Madrid; *by E. of Sandwich*, n. 32. p. 390.

LXIV. 1. *Dec.* 25. 1666. In the Evening here (*viz.* at *Madrid*) was a great *Halo* about the *Moon*; the Semidiameter whereof was about $23^{\circ} 30'$. *Aldebaran* was juſt in the North-Eaſt part of the Circle, and the two *Horns* of *Aries* juſt encloſed by the South-Weſt of the Circle, the *Moon* being in the Center. I note this the rather, becauſe 5 or 6 Years ago, *viz.* *Nov.* 21 1661. an hour after Sun-ſet, I ſaw a great *Halo* about the *Moon*, of the ſame Diameter, at *Tangier*, the *Moon* being very near the ſame place, where ſhe was now.

At Paris, by M —— n. 60. p. 1065

2. *May* 12. 1667. An *Halo* or Circle about the *Sun*, was obſerv'd by the *Philoſophical Society* at *Paris*. The Diameter of this Circle, was found to be of 4 *Degrees*, and the Breadth of the Limb thereof, about half a *Degree*. The upper and lower parts were of a *Vivid Red* and *Yellow*, with a little *Purple* Colour, but eſpecially the upper, the *Red* was within the *Circle*. The other parts appeared but *Whitiſh* and of little Clearneſs. The Space within the *Halo* was a little Darker than that about it, eſpecially towards the parts that were *Coloured*. Beſides, there was ſeen the *Proportion* of another *Great Circle*, which touched the *Halo* above, and whoſe Extremities were bent downward, as is repreſented in the *Figure*. This *Portion* of a *Circle* had alſo its Colours like thoſe of the *Halo*, but fainter. The height of the *Sun* at the beginning of the Obſervation, was about 46. *Deg.* There were in the Air little white Clouds, which ſomewhat Tarniſh'd the Blue Colour of the Heavens and leſſened the brightneſs of the *Sun* which ſhone as in an *Eclipſe*. The Weather was Cold, conſidering the Seaſon of the Year; and it was affirmed for certain, that it had *Frozen* the Night before. This *Halo* appear'd in the ſame Beauty and Splendor of Colours unchanged from 9 in the Morning, (when it began to be obſerv'd) untill about half an hour paſt 10; after which time it became Fainter and Fainter till two of the Clock in the Afternoon (when it ended,) after it had reſumed a little more Force ſometime before it diſappear'd.

Fig. 76

At Dantzick; By M. Hevelius, n. 124. p. 589.

3 *Jan.* 1. *St. N.* 1676. H. 3. 46′. Durante *Eclipſi*, ingens *Halo Lunam* cinxerit.

At Oxford; By M Halley. p. 129.

4. *Aug.* 2′. 1676. At 12. h 40′. At Night a *Halo* encompaſſed the *Moon*, in whoſe Circumference was *Saturn*, the *Pleiades*, *Capella*, and the *following* of the *Foot* of *Perſeus*.

Parhelia *obſerved in* France; *By* M...... n. 13. p. 219.

LXV. 1. *April* 9. 1666. About half an Hour paſt 9. there appeared three *Circles* in the *Sky*. *One* of them *SCHN*, was very great, a little interrupted, and *White* every where, without the Mixture of any other Colour. It paſſed through the midſt of the *Sun*'s Disk, and was Parallel to the *Horizon*. Its Diameter was above 100 *Degrees*, and its Center not far from the *Zenith A*.

Fig. 27.

The *Second DEBO*, was much leſs and Defective in ſome places, having the *Colours* of a *Rainbow*, eſpecially in that part which was within the great *Circle*. It had the true *Sun R.* for its Center.

The *Third HDN*, was leſs than the *Firſt*, but greater than the *Second*; it was not entire, but only an *Arch* or Portion of a *Circle*, whoſe Center was far diſtant from that of the *Sun* and whoſe Circumference did by its Middle, joyn to that of the *Leaſt Circle*, with which it was confounded at *D*, and interſected the *Greateſt Circle*, by its two Extreams. In this *Circle* were diſcerned alſo the *Colours* of a *Rainbow*, but they were not ſo ſtrong, as thoſe of the *Second*.

At the Place, where the Circumference of this *Third Circle* did cloſe with that of the *Second*, there was a great Brightneſs of *Rainbow-Colours*, mixt together: And at the two Extremities, where this *Second Circle* interſected the *Firſt*, appeared two *Parhelia*'s or *Mock-ſuns*, *H*, *N*; which ſhone very bright, but not ſo bright, or ſo well defined, as the *True Sun*. The Midſt of theſe two *Falſe Suns* was *White* and very Luminous: And their Extremities towards *DI*, were *Tinged* with the *Colours* of a *Rainbow*. The *Falſe Sun H*, that was towards the *South*, was bigger, and far more Luminous, than that towards the *Eaſt*.

There was alſo upon the *Firſt* Great *Circle*, a *Third Mock-Sun*, *C*, Situated to the *North*, which was leſs, all *White*, and far leſs Shining than the Two others. There was a ſpace very dark betwixt *R* and *D*.

This Appearance is look'd upon as one the Notableſt that can be ſeen, by Reaſon of the Excentricity of the Circle *HDN*, and becauſe that the *Parhelia* were not in the Interſection of the Circle *DEBO* with the great Circle *SCHN*; as they appear'd at *Rome*, *March* 29. 1629. but in that of the Semicircle *HDN*.

Gaſſendi Meteor. c. 10.

In Hungary; *By* Dr. Edw. Brown, n. 47. p. 953.

2. A Learned Jeſuit call'd Father *Michael*, who lives at *Presburg*, communicated to me an Account of two *Parhelia*'s, which were ſeen *Jan.* 30. 1669. *St. N.* about one of the Clock in the Afternoon, over the City of *Caſſovia* in *Hungary*.

There was one on each ſide of the *True Sun*, and they were ſo reſple dant, that the Naked Eye could not bear the brightneſs thereof. *One* them (the leſſer of the two) began to Decay before the *other*, and then *other* grew Bigger, and continued well nigh two Hours, projecting very lo Rays from it ſelf. They were *both*, on that part which was towards *Sun*, *Tinged* with a pale *Yellow*, the other parts being ſomewhat Fuſc There were at the ſame time ſeen ſeveral *Rainbows*, together with the ment of a great *White Circle*, of a long Duration, paſſing through the two *Parhelia*'s and the *Sun*: And all this at a time, when the Air was almoſt free from Clouds, though here and there were ſcatter'd ſome very thin ones.

At Dantzick; *By M.* Hevelius, n. 66. p. 2026.

3. *An.* 1670. *Oct.* 11. *St. N. H.* 7. 40′. Tres *Parhelii* apparuerunt.

At Marienburgh in Boruſſia; *By M.* Hevelius, n. 102. p. 26. *Fig.* 28.

4. *Feb.* 5. 1674. *St. N.* Not far from *Marienburgh* in *Boruſſia*, I ſaw the *Sun* (in a Sky every where Serene enough) being yet ſome *Degrees* above the *Horizon*, and ſhining very bright, yet lanching out very long and *Reddiſh* Rays, 40 or 50 *Degrees* toward the *Zenith*. Under the *Sun*, towards the *Horizon*, there hung a ſomewhat dilute ſmall Cloud, beneath which there appear'd a *Mock-Sun*, of the ſame bigneſs (to Senſe) with the *True Sun*, and under the ſame Vertical, of a ſomewhat Red Colour. Soon after, the True-Sun more and more deſcending to the *Horizon* towards the ſaid Cloud, the *Spurious Sun* beneath it grew clearer and clearer, ſo that the *Reddiſh* Colour in that *Apparent Solar* Disk Vaniſh'd and put on the *Genuine* Solar Light, and that the more, the leſs the *Genuine* Disk of the *Sun* was diſtant from the *Falſe Sun*: Till at length, the upper *True Sun* paſſed into the lower Counterfeit one, and ſo remained alone.

Fig. 29. *Fig.* 30.

Upon this appearance there ſoon followed here an exceedingly Intenſe and bitter *Froſt*, whereby the whole *Sinus Puzenſis* was *Frozen* up, from this Town of *Dantzick*, as far as *Hela* in the *Baltique Sea*, which laſted unto the 25 of *March*, and the *Bay* was *Frozen* ſo hard, that with great ſafety People run out into it with Sleds and Horſes, for ſeveral of our Miles.

In Suffolk; *By Mr.* Petto, n. 250. p. 107.

5. *Aug.* 28. 1698. about 8 a Clock in the Morning, ſome Perſons at *Sudbury* in *Suffolk* ſaw the Appearance of *Three Suns*; 'tis ſaid, then the Apparition was moſt Full, or a little after. About ½ an Hour after 8, I my ſelf ſaw it; there was in the Eaſt, a Dark, Dusky, Watry Cloud, and below it towards the Middle, was the *True Sun*, ſhining with fierce and piercing Beams, that Perſons could not look upon it; on each ſide were the *Reflections*, with the *True Sun* in the Middle. Elſewhere much of the Firmament. was of on Azure, Light-Blue Colour. The Circles which I ſaw, was not of *Rainbow* Colours, but *White*. There was alſo, higher in the Firmament, more over our Heads, and toward the South, at the ſame time, at a conſiderable. Diſtance from the other, the Form of a Half *Moon*; but I think it was more than twice the Bigneſs of a half Moon, with the Horns turned upward, and within of a fiery *Red* Colour, and more like a *Rainbow* Colour, theſe all faded gradually; they continued in all, I ſuppoſe two Hours.

At Canterbury; *By Mr.* St. Gray, n. 251. p. 126.

6. *Feb.* 26. 169$\frac{8}{9}$. about half an Hour after 3. in the Afternoon, chancing to look out of a Window that faced South-Eaſt I ſaw not far from the South to the Weſtward, an Appearance of ſomewhat not much unlike the *Sun* when ſeen through Clouds, *viz.* with its Periphery not exactly defined: From which it likewiſe differed, in that one half of it was coloured Deep *Red* and *Yellow* the other *White*. I went immediately into the Garden, and ſaw an Appearence exactly like the former, but on the Oppoſite ſide of the *Sun*. The Diſtance of this was 23°. from the *Sun*, to the Weſtward; but before I could take the Diſtance of the Eaſtern one, it vaniſhed,

but ſoon after Re-appear'd, and then I perceived manifeſtly, that they were both ſituate in the Extremities of a *Semicircle*, whoſe Center was the *Sun*, paſſing betwixt it and the *Zenith*. This Appearance continued about half an Hour.

At Canterbury; By Mr. St. Gray, n. 262. p. 535. *Fig.* 31.

7. *Apr.* 7 1699. Between 4 and 5 a Clock, there appeared on each ſide the *Sun A*, a *Parhelion*, *B C*, connected by an *Halo BDC*, of the uſual Diameter, they had each of them a *Tail* of a *Whitiſh* Colour, extended oppoſite to the *Sun* of about 15 or 20 *Degrees* in Length, the upper part of the *Halo* was touched at *D*, by the Arch of a Circle, whoſe Ends were turned towards the *Zenith Z*; it had the Colours of the *Iris*, but faintly; betwixt this and the *Zenith* was another Portion of a Circle *E*, which had the Colours of the *Iris* with greater Vivacity than the former.

Rainbows *obſerved in* France; By M. Eſtienne, n. 13. p. 221. *Fig.* 32.

LXVI. 1. *An.* 1665. *Aug.* 10. About half an Hour paſt 6 in the Evening two odd *Rainbows* appeared at *Chartres* in *France*, croſſing one another almoſt at Right Angles. The *Rainbow*, which was oppoſite to the *Sun*, in the uſual manner, was more deeply *colour'd*, than that which croſs'd it: And its greateſt height, was about 45 *Degrees*. The Feebler *Rainbow* loſt one of its Legs, by growing Fainter, about 20 *Degrees* above the ſtronger; and the Leg below appeared continued to the *Horizon*. This ſeem'd to be a Portion of a great Circle; and the Stronger was but a Portion of a ſmall Circle, as uſually.

The *Sun*, at their Appearance, was about 6 *Degrees* high above the *Horizon*. The River of *Chartres*, which runs very near from South to North, was betwixt M. *Eſtienne* (the Obſerver) and the *Rainbow*, and he ſtood level with the River, whence he was diſtant not above 150 Paces.

At London; By Mr. Edm. Halley n. 240. p. 195.

2. *Mar.* 11. 1696. It Rain'd pretty thick a ſmall Rain, and the *Sun*, about 2 of the Clock, ſhone directly down *Abchurch Lane*, as I was paſſing along it with my Back to him, when I perceived the Arch of the *Primary Rainbow* in the Drops of Rain, ſpanning the Street like an Arch of a Building under which I was to paſs, the Crown whereof was not much higher that my Head, and the Diameter thereof ſcarce ſo wide as the Street, which is but 5 Yards; and it moved along with me as faſt as I went; the Colours being very Vivid and Diſtinct, though the Arch it ſelf appear'd but narrow, and the Houſes were every where behind it. This, tho' very uncommon, will not appear ſtrange to thoſe who have well conſidered the Nature of the *Iris*.

At Cheſter; By Mr. Edm. Halley, n. 240. p. 193.

3. *Aug.* 6. 1698. Between 6 and 7 a Clock in the Evening, I obſerved an *Iris*, exceedingly Vivid, as to its Colours, at firſt on the Southſide only, but in a little time with on entire Arch; and ſoon after, the Beams of the Sun being very ſtrong, there appear'd a *Secondary Iris*, whoſe Colours were, more than Ordinary Bright, but inverted, as uſually: That is, the *Red* was inwards, which in the *Primary Iris* is outward, and *e contra* for the *Blues*. But what I took moſt notice of was, that with theſe two Concentrick Arches, there appear'd a third Arch, near upon as bright as the *Secondary Iris*, but Coloured in the Order of the *Primary*, which took it Riſe from the Interſection of the *Horizon* and *Primary Iris*, and went croſs the Space between the two, and

in

interſected the *Secondary*, as in the *Figure* *AFCG* Interſects the *Secondary Iris* *EFGD*, dividing the Arch *ED* into three equal Parts, as near as I could then gueſs: But at firſt the Arch *AF* did not appear, which afterwards became as bright as the former. I obſerved the Points *F*, and *G*, to ariſe, and the Arch *FG*, gradually to contract, till at length the two Arches *FHG*, and *FG*, became coincident; when, for a great ſpace, the *Secondary Iris* loſt its *Colours*, and appeared like a white Arch at the top. I obſerved alſo, that at the Points *F*, and *G*, the Interſection of the interior *Red* of the *ſecondary Iris*, and the exterior *Red* of the Arch was much more intenſly red than the outward Limb of the *Primary Iris*, and that during the whole Appearance, the upper part of the *Third Iris* was not at all viſible, beyond the Interſections *FG*. This uncommon Sight entertained me for about 20 *min.* when the Clouds blowing away, the whole vaniſhed. I was at firſt amazed with the Sight, but afterwards, recollecting that the Sun ſhone along the River *Dee*, which from thence empties it ſelf into the *W. N. W.* where the Sun then was, I concluded this ſecondary Arch *AFHGC*, was produced by the Beams of the Sun reflected from that Water, which at that time was very calm; and it had been much more bright, had it been at that time about high, as it was low Water, when all the Sands were bare. I was ſoon confirmed that my Suppoſition was right, and that it anſwered all the Appearance without any Scruple, and that the Arch *AFHGC*, was no other than that part of the Circle of the *Iris*, that would have been under the Earth, bent upwards by Reflection.

Fig. 33.

I remember not to have read of any ſuch *Iris* in any Author. *Des Cartes* indeed ſpeaks of an inverted *Iris* by *Reflection*, but it is not poſſible to be ſeen as he deſcribes it: And I quary whether ever any ſuch has been really obſerved.

The Cauſes of Halo's *and* Parhelia, *conſidered, by* M. Hugens, n. 60. p. 1066. *Vide ſupra*, S. LXIV.

LXVII. The Obſervation of the *Halo*, which appeared at *Paris*, *May* 12. 1667, engaged M. *Hugens* to propoſe to the Academy there, what he had meditated ſome Years before, not only of theſe *Halo*'s, but alſo of the *Parhelia*. As for *Halo*'s, he ſaid, that they were formed by ſmall round *Grains* made up of two Parts, one tranſparent the other opaque; the latter being incloſed in the former, as a Cherry-ſtone is in a Cherry. Thus *AA*, repreſents one of theſe Grains, and *B*, the *Kernel*, or opaque part.

He related the Obſervations of thoſe who have ſeen *Hail* formed after this manner, and explain'd how that ſome of theſe little Grains, which ſwim up and down in the Air betwixt us and the Sun, being leſs diſtant from the Axis, which extends it ſelf from the Sun to our Eye, than of a certain Angle, do neceſſarily hinder the rays which fall on them from coming to our Eyes, in regard that the opaque *Kernel* is the Cauſe that there is behind every ſuch *Grain* a ſpace of a *Conical Figure*, as *MNO*, in which the Eye of the Spectator being ſituated cannot ſee the Sun thro' that Grain, tho' it may ſee him when poſted elſewhere, as ſome where in *P*.

Fig. 34.

And to make the Company the more diſtinctly to underſtand the Effect which theſe *Grains* ſuſpended in the Air muſt produce, he drew the 35. *Fig.* in which *B*, is the place of the Eye; *BA*, the *Axis* which paſſeth from the Eye

Fig. 35.

to the Sun : *C*, *M*, *F*, ſome of the *Icy Grains* with their Kernel, making them halfopaque: Among which the *Grain C*, being in the Axis, *B A*, and the Lines *CK*, *LH*, repreſenting the Rays of the *Sun* neareſt to the Axis, the paſſage of which is not hindred by the opacity of the *Kernel*, it is certain, not only that the *Grain C*, will not be able to tranſmit any Ray of the Sun towards *B*, but alſo that, imagining the Superficies of a Cone, whoſe Top is in the Eye, and its ſides *BD*, *BE*, parallel to the Rays *CK*, *LH*; all the *Grains MM*, which this Superficies ſhall comprize, will likewiſe not ſuffer any Ray to paſs to the Eye, becauſe it muſt needs be in their *Cone* of Obſcurity ; but thoſe that ſhall be without this Superficies, as the *Grains F, F*, will let them paſs, becauſe the Eye is without their *Cone* of Obſcurity. Whence it follows, that the Angle of this *Cone BDE*, is that which determines the Diameter of the *Halo*, which depends from the Proportion, the opaque *Grain* hath to the tranſparent, in which it is encloſed. For if this Diameter is of 44 *Degrees*, as is obſerved in moſt *Halo*'s, the bigneſs of the opaque *Grain* will be to the Tranſparent, as 40 to 19. But he ſaid, that this Proportion was not always the ſame, and that the Diverſity of it was the Cauſe, that ſometimes there were ſeen many *Halo*'s, one about the other, all having the Sun for their Center.

He added, that it was eaſy to know, why theſe *Halo*'s were always of a round Figure, whether the Sun be little or much raiſed above the Horizon ; as alſo to give a Reaſon of their Colours, which is the ſame with that in the Triangular Glaſs *Priſms* ; as is evident by the *Tangents A C*, drawn to the *Grain A*, at the Points, where the *Ray DA*, enters or comes out.

Further he took notice, that it was alſo manifeſt, why the red Colour is in the interior Circumference of the *Halo*, and why the Space, which it taketh in, and chiefly near the moſt lively colour'd parts, appears obſcurer than the Air about ; *viz.* becauſe it is there, where moſt Grains are, which tranſmit no Rays of the *Sun* to our Eyes, and ſo do nothing but darken the Air, as the Drops of Water when it raineth.

As to the *Arch* of the *Circle*, which above touched the *Halo*, ſeen *May* 12. 1667, as alſo that the Colours were more vivid in this Place, and in that below than in the reſt of the Circle ; he ſaid, that theſe Effects did not proceed from the Grains he had been ſpeaking of, but from another Cauſe, which did alſo ſerve for the Production of the *Parhelia*, and the *Circles* which almoſt ways accompany them. Touching which *Circles* and *Parhelia*'s, he told the Company, that beſides the round and half dark Grains, there were alſo formed in the Air certain little *Cylinders* of the like Nature : Which being ſuppos'd to be oblong icy Grains, and roundiſh at both Ends, having the inner Kernel of the ſame Shape, it was found, that from their different Diſpoſitions all the Appearances of the *Parhelia* and their *Circles* did neceſſarily follow.

Fig. 36.

And firſt, that ſome of theſe *Cylinders* being erect, in the Situation which probably they ought to have in being formed there, muſt appear in the Heavens a great *white Circle*, parallel to the Horizon, paſſing thro' the Sun, and of near the ſame Breadth with him ; as hath been obſerved in the *Phænome-*

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ion of *Rome*. *An.* 1629. of which *Gaſſendus* and *Des Cartes* have written, and which is here exhibited.

That this *Circle LKNM*, is cauſed by the *Reflection* of the Rays of the *Sun* upon the ſurface of theſe *Cylinders*, it being eaſy to demonſtrate, that there are none but thoſe which are raiſed at the ſame *Angle* above the *Horizon* with that of the height of the *Sun*, that can reflect his Rays to our Eyes. Whence it manifeſtly follows, that it muſt appear *white*, and throughout of equal Altitude with the *Sun* it ſelf, and by conſequence parallel to the *Horizon*. That conſidering afterwards the tranſparency of theſe perpendicular *Cylinders*, and their opaque *Kernels*, it is eaſily ſeen, that thoſe of the *white Circle*, which are diſtant from the *Sun* at a certain *Angle*, begin to give Paſſage to his *Rays* to ſtrike our Eyes in the ſame manner as hath been ſaid of the round half dark *Grains*. That theſe *Cylinders* are thoſe, which on each ſide of the *Sun* make us ſee a *Parhelion* in the great *white Circle*, as hath been noted in the Obſervation of *Rome*, where they are mark'd with *K* and *N*, and in many others. That theſe *Parhelia* have commonly luminous *Tails*, becauſe the *Cylinders*, which follow thoſe firſt ones that form the *Parhelia*, and which are yet further diſtant from the Sun, let alſo paſs his Rays to our Eye; ſo that theſe *Tails* may be 20 *Degrees* and more in length. That the ſame *Parhelia* are always colour'd, becauſe they are made by *Refraction*, as the *Halo*. Fig. 37.

That beſides, there are two other Images of the *Sun* generated by theſe Perpendicular *Cylinders*, and ſo diſpoſed in the great *white Circle*, that the Spectator turning his Face towards the *True Sun*, hath them behind him; as in the *Roman* Obſervation are the *Parhelia L* and *M*. That theſe are produced by two *Refractions* and one *Reflection* in theſe *Cylinders*, in the ſame manner as the ordinary *Rainbow* in the Drops of Water, according as M. *Des Cartes* hath declared: So that the *opaque Kernels* do nothing to the Production of theſe two *Suns*, but that they may be ſometimes ſo big as to make them not appear. That according to the *Altitude* of the *Sun*, more or leſs, theſe two *Parhelia* are more or leſs nigh to one another. That they ſhould appear colour'd as the *Rainbow*, and that ſometimes they have been ſeen ſuch; but that when they are faint, they may alſo ſeem white, even as the *Halo*'s when they are not very bright.

That theſe ſame Perpendicular *Cylinders* can alſo produce an *Halo* about the *Sun*, by reaſon of the Rounding of their two Ends; which maketh, that being diſtant from the Sun at a certain Angle, on what ſide ſoever it be, they begin from thence to give Paſſage to the Rays, tranſmitting them to the Eyes of the Spectator.

And that theſe *Halo*'s are probably thoſe, we ſee almoſt always paſs thro' the two *Parhelia* that are on the ſides of the *True Sun*, as the *Halo GKNI*, in the Phænomenon of *Rome*.

That there is yet another Situation of theſe *Cylinders* very conſiderable, which is of thoſe that are couchant, ſo as their Axes are parallel to the Plane of the *Horizon*, but turned divers ways, ſome one ſome another way, like Needles confuſedly thrown on the Ground: Which *Horizontal* Diſpoſition, is very natural to thoſe *Cylindrick* Bodies ſupported by the Vapours, which riſe from the Earth, as may be made out experimentally in Bodies thus figur'd; being let fall in the Air.

That it is in theſe *Cylinders* that the Arches which touch the *Halo*'s above or below, are formed; ſuch as there were in the *Phænomenon* obſerv'd at *Rome A.* 1630, which is deſcribed by *P. Scheinir* in a Letter to *M. Gaſſendus*, as alſo in all thoſe which M. *Hevelius* had related at the End of his *Mercurius in Sole*.

And that the *Arch*, which appeared upon the laſt *Halo* at *Paris*, *A.* 1667, was of the ſame kind. That the Figure of theſe *Arches* is different according to the different Altitudes of the *Sun*, and the ſeveral Magnitudes of the Diameters of the *Halo*'s.

That when the *Sun* is very nigh the *Horizon* ſuch an *Arch* appearing up-
Fig. 38. on an ordinary *Halo* of 44 *Degrees*, muſt repreſent as 'twere two *Horns*, as in *Fig* 38. *AB*, *AC*. But that the *Sun* riſing higher, thoſe *Horns* become lower in Proportion, and make ſuch Arches as are repreſented in the ſame *Fig.* where each height of the *Sun* is mark'd near the *Arch* which it is to make.

That the place of the *Arches* where they touch the *Halo*'s, being more ſtrongly enlightned and colour'd than the reſt maketh us judge that there are *Parhelia* in thoſe places. That the Reaſon why theſe *Arches* do ordinarily touch a *Parhelion*, was, that the ſame *Cylinders couchant*, which produce the Arch, produce alſo that *Parhelion*, by the means of their two round and tranſparent Ends, in the ſame Manner as hath been ſaid of the *Perpendicular Cylinders*. And that the *Parhelion* laſt ſeen at *Paris*, had been form'd in theſe *couchant Cylinders*. That that was alſo confirmed, by reaſon that it was brighter in the ſuperior and inferior part than any where elſe; which neceſſarily comes to paſs in a *Parhelion* cauſed by *Cylinders* thus diſpoſed, whereas when produced by the *round Grains*, it muſt appear every where equally ſtrong.

That in theſe ſame *Cylinders Parallel* to the *Horizon*, there is alſo found the Cauſe of the *white Croſs*, obſerv'd together with the *Paraſelene*'s or *Mock-moons*, by M. *Hevelius*, and exhibited at the end of his *Mercurius in Sole*, the perpendicular Fillet of that Croſs coming from the Reflection of the Rays of the Moon upon the ſurface of theſe Cylinders, as the other Fillet, parallel to the *Horizon*, is produced by the Reflection of the Perpendicular Cylinders which make the great white Circle, of which this Fillet is a part. That yet the Moon muſt not be very high above the Horizon, to the e that the couching Cylinders may produce this Effect: And that it ſhou be well heeded, when the like Meteors ſhall appear, whether the Perpe dicular Fillet be not narrower where it paſſeth thro' the Moon, than in ther places, and eſpecially upwards, where it muſt grow larger and diſap pear That beſides the Perpendicular Cylinders, and thoſe that are cou ched parallel to the Horizon, there are often a great many, which mov to and fro in the Air, in all ſorts of Poſitions, and that thoſe, by the ſam reaſon that the round Grains do, muſt produce an Halo about the Sun, an even a more vivid one than that which is cauſed by the Grains, for as muc as each Cylinder ſends many more Rays to the Eye, than each of theſe litt
Fig. 37. Spheres. That the little Halo *DLF*, in the *Roman Phænomenon* (*Fig.* 37.) m very well have been cauſed by ſuch Cylinders.

As to thoſe *Mock-ſuns*, which ſometimes ſhow themſelves directly oppoſite to the true Sun (ſuch an one as was publiſhed by M. *Hevelius*, and obſerv'd *Feb.* 23. 1661.) that he could find nothing, neither in the round Grains nor in the Cylinders, which ſhould make theſe *Suns* neceſſarily to meet in the great white Circle, parallel to the Horizon, and that if that ſhould be always verified by future Obſervations, the Cauſe of it muſt be look'd for elſewhere: But that in the mean time he did believe, that that happened not but by chance; which being ſo, a Reaſon might be given of theſe *Suns*, by the ſame Suppoſition, which ſerved alſo for the *Anthelion*, obſerved by M. *Hevelius*, *Sept.* 6. 1661; in which there were two coloured Arches of a Circle, oppoſite to the *Sun*, which did interſect one another, their Interſection being the Place of the falſe Sun. Which although it be repreſented in the Figure of *Hevelius*, at the ſame height with the true Sun, yet it was in truth higher by 15 *Degrees* or more; as he hath acknowledged himſelf afterwards: So that, if there had been a great white Circle in this *Phænomenon*, the *Parhelion* was not at all to have been in it.

That for the Generation of theſe Suns, he did ſuppoſe a Number of ſmall Cylinders with opaque Kernels, as the precedent, which were carried in the Air, neither perpendicularly nor couching, but inclined to the Plane of the Horizon at a certain Angle, being near a half right one; to which were particulaaly appropriated thoſe Cylinders, which M. *Des Cartes* ſaw fall from the Heavens, having Stars at both ends; as may be ſeen experimentally by forming Cylinders of that Faſhion, which is repreſented in *Fig.* 39. and letting them deſcend in the Air, or in Water. Fig. 39. That in theſe Cylinders was found the following *calculus* to be given in another Treatiſe of *Parhelia*'s, not only the Cauſe of the *Anthelia* made by the Interſection of two Arches, as in *Fig.* 40. but alſo that of ſome other extraordinary Arches and Rods, Fig. 40. that are ſometimes obſerved near the *Sun*, of which notwithſtanding there could nothing be as yet affirmed with certainty, for want of exact and faithful Obſervations.

To make all theſe different Effects of the Cylinders manifeſt to the Eye, M *Hugens* produced one of Glaſs, a Foot long, of the ſhape of that in *Fig.* 36. Fig. 36. and for the Kernel opaque in the middle of a Cylinder of Wood, and the ambient ſpace filled with Water inſtead of tranſparent Ice: Which Cylinder being expoſed to the Sun, and the Eye put in ſuch places as was requiſite, there were ſucceſſively ſeen all thoſe Reflections and Refractions that have been diſcourſed of. Whence it might be concluded, that a great Number of the like Cylinders, altho' very ſmall in Compariſon to that, being found the Air, and having the ſeveral Poſtures that have been ſuppoſed, all the ppearances of the *Parhelia* and their Circles muſt exactly follow.

It was wiſhed, for an entire Confirmation of the Truth of this *Hypotheſis*, at ſome of thoſe ſmall Cylinders could be obſerved to fall to the ground, the time when any *Parhelia* do appear: Which yet he ſhewed could not ſily be done, becauſe that the Vapours, which then riſe from the Earth pwards, and which are the Cauſe of their Cylindrical Figure, keep them ſo ſuſpended in the Air. He added, that it was not to be thought ſtrange,

that ſuch ſmall Grains of Hail were thus kept in the Air by the Vapours, for as much as theſe, by being rarified and dilated upwards, might have motion enough for this Effect; and that that was much more eaſy to conceive, than to imagine how theſe ſame Vapours could keep ſuſpended a very great and weighty Circle of Ice, ſuch as M. *Des Cartes* ſuppoſeth to explicate the cauſe of *Parhelia*'s, and of the great white Circle of the *Roman* Phænomenon.

Optical Affections concerning the Rainbow; by M. Fr. Linus, n. 117. p. 386.

LXVIII. 1. Minima quævis Pluviæ Guttula, Radiis *Solaribus* illuſtrata, mittit ex ſe *Iridem* perfectam, non ſolum quoad ipſos *Colores*, ſed etiam quoad eorum Ordinem, Situm, ac Figuram Circularem, ei quam in Cœlo videmus ſimillimam.

2. Radii enim *Solares* Guttulam ſubintrantes, indeque poſt duas Refractiones & unam Reflectionem iterum verſus *Solem* redeuntes erumpunt è Guttula *Colorati*, iiſdemque plane *Coloribus*, quos in *Iride* videmus, *Rubro*, *Flavo*, *Viridi*, *Cæruleo*, & *Purpureo* imbuti.

3. Hi Radii ſic Colorati, dum Pluvioſo Cœlo à variis Guttulis *Sole* illuſtratis in Oculum tranſmittuntur, Viſionem, quam de *Iride* habemus, efficiunt.

4. Dantur autem in qualibet Guttula duo *Annuli*, Major & Minor diſtinctis *Coloribus Irialibus* imbuti; quorum minor diſtat ab Axe ſeu Radio tranſeunte per Centrum Guttulæ *Gradibus* circiter 21; Major autem ab eodem Axe diſtat *Gr.* 78. Radii autem incidentes in minorem Annulum, inde reſiliunt in majorem; è quo erumpentes in Aerem, dictis *Coloribus Irialibus* imbuuntur.

5. Oriuntur igitur hi Colores a Radiis Solaribus; ſed non ab iis ſolis (uti hactenus exiſtimatum) ſed etiam a Radiis ipſius Aeris, Corpus Solare ambientis.

6. Sed neque oriuntur hi Colores ab omnibus iis Radiis, ſive Solaribus, ſive Aeriis, qui Guttulam ſubintrant; ſed ab iis ſolummodo, qui emittuntur ab ipſo Limbo Solari Aereque ei vicino.

7. Quin & ii Radii, qui ſic a Limbo *Solari Æreque* vicino in Guttulam tranſmittuntur, non omnes ſpectant ad dictos Colores, nec erumpunt Colorati; ſed illi duntaxat, quorum Angulus Incidentiæ nec minor eſt *Gradibus* 45, nec major *Gradibus* 75.

8. A Limbo itaque Solari, vicinoque Aere procedunt Colores Iriales, non tamen omnes quinque immediate inde fluunt; ſed quatuor duntaxat, nempe *Ruber*, *Flavus*, *Cæruleus*, & *Purpureus*. *Virilis* enim oritur ex Radiis *Flavis* & *Cæruleis* inter ſe permixtis.

9. Oriuntur igitur hi quatuor Colores a dicto Limbo, non tamen omnes ab una eademque ejus parte. Sed duo ex iis ab una parte Limbi, & alii duo ab alia ei directe oppoſita; *v. g.* a Limbo ſuperiore oriuntur *Cæruleus*, & *Purpureus*, & ab inferiore, *Ruber* & *Flavus*.

10. Cauſa autem, cur a Limbis adeo inter ſe ſimilibus oriantur *Colores* tam diſſimiles, non alia hic apparet, quam quod in uno caſu Limbus *Aerius* ſit ſupra Limbum ſolarem, & in alio Limbus ſolaris ſit ſupra *Aerium*. Hoc autem Diſcrimen videtur hic ſufficere, eo quod, Ratione illius diverſi Situs nunc

Radii Solares incurventur per Refractionem ſupra Radios *Aereos*, nunc e contra *Aerii* ſupra *Solares*.

11. Oriuntur itaque hi Colores per dictos Radios refractos, ita tamen refractos ut per eam Refractionem valde inter ſe conſtipentur. Nam omnes Radii a *Gradu* 45. uſque ad 60. ad Spatium unius *Gradus* in minore *Annulo* contrahuntur : In quod etiam tam anguſtum Spatium confluunt, per Retrogradationem. Radii omnes a *Gradu* 60 ad 75.

12. Quando plures Homines ſimul vident *Iridem*, tot videntur *Irides*, quot ſunt Homines videntes.

13. Qui intuetur *Iridem*, videt Singulis Momentis aliam & aliam.

The Colours *and* Diameter *of the* Rainbow, *from the given* Proportional *of* Refraction *And the* Contrary: *by* Mr. Edw. Halley, n. 267. p 714.

LXIX. *Iridis* Phænomena attente reſpicientibus ſemper conſtabat, *Solis* Radios a Nube aquoſa reflectos, ſub certo quodam *Angulo* in Oculum incurrere ; unde forma ejus *Arcuata*, Colorum autem cauſa, ut etiam magnitudinis *Anguli* iſtius, quo conſtanter ab oppoſito *Solis Iridem* diſtare deprehendimus, tam modernos quam veteres diu multumque torſit; nec quiquam profecere uſque dum præclarus ille *Carteſius*, in auxilium collatis *Mathematicis* Diſciplinis, ſpeculationes has Phyſicas ſtrictiori argumentandi Methodo tractari poſſe ac debere, pluribus Exemplis edocuit ; Inter alia vero *Iridis* Theoriam expoſuit. Ex hujus demonſtratis conſtat, *Iridem Primariam* a talibus Solis Radiis produci, ubi *Exceſſus* duorum *Angulorum Refractorum* ſupra unicum *Incidentiæ Angulum* omnium poſſibilium fuerit *Maximus : Secundariam* vero *Iridem* formari ab iis Radiis tantum, ubi exceſſus trium *Angulorum Refractorum* ſupra unum *Incidentiæ Angulum* ſimiliter ſit omnium *Maximus*. Ac pergere licet ad tertiam, quartamve, vel quamvis aliam *Iridem*, quæ fiunt ubi Radii, poſt tres, quatuorve, vel plures Reflectiones e Guttulis emergunt. In omnibus autem his Regula eſt generalis, ut Exceſſus quatuor vel quinque vel plurium *Angulorum Refractorum* (numero. *Scil. Reflectionum* unitate aucto) ſupra unum *Incidentiæ Angulum* ſit omnium Maximus. Exceſſus autem iſte *Maximus* Duplicatus ubique eſt Diſtantia *Iridis* ab oppoſito *Solis*, ubi numerus *Reflectionum* impar eſt : Si vero par ſit iſte Numerus, duplum *Anguli* iſtius *Maximi* ſit diſtantia *Iridis* a *Sole* ipſo.

Ut autem habeantur Exceſſus iſti *Maximi*, data liquoris alicujus *Refractione*, ſive ratione ſinus *Anguli Incidentiæ* ad ſinum *Anguli refracti*, obſervandum eſt, *Exceſſum* duorum *Angulorum refractorum* ſupra unum Incidentiæ Angulum, *Maximum* fieri ubi augmentum momentaneum Anguli Incidentiæ præciſe duplum eſt augmenti momentanei *Anguli Refracti*, Trium vero *Angulorum Refractorum Exceſſum maximum* eſſe, ubi augmentum momentaneum *Anguli Incidentiæ* triplum eſt momenti *Anguli Refracti :* & ſic de cæteris. Atque hoc per ſe ſatis evidens eſt, Angulus autem ipſos obtinebimus præmiſſo *Lemmate* ſequente, quod demonſtrare oportet.

Lemma. *Manentibus Cruribus Trianguli cujuſvis Plani, ſi augeatur vel minuatur Angulus Verticalis Angulo quovis dato minore, erunt Momenta ſive Mutationes inſtantaneæ Angulorum ad Baſin, inter ſe reciproce ut Segmenta Baſis.*

Sit

Fig. 41. Sit *ABC*, Triangulum cujus Vertex *A*, Crura *AB*, *AC*, & Baſis *BC*, in quam demittatur Perpendiculum *AD*: Dein augeatur Angulus *BAC*, Momento aliquo indiviſibili *CAc*, ac ducantur lineæ *Bcd*, *cD*, quæ non niſi intellectu differunt á lineis *BCD*, *CD*. Dico Momentum Anguli *ABC*, nempe *CBc*, eſſe ad Momentum Anguli *ACB*, vel *ACD*, ut *CD*, ad *BD*, hoc eſt reciproce ut Segmenta Baſis. Cum enim Angulus *ACD*, ſit ſumma Angulorum *ABC*, *BAC*, Momentum ejus erit etiam ſumma Momentorum iſtorum Angulorum ſive $CAc + CBc$, ſed *CAc*, æqualis eſt Angulo *CDc*, quoniam ab Angulum rectum ad *D*, puncta *A*, *D*, *Cc*, ſunt in Arcu Circuli cujus Diameter eſt *AC*, per *Euclid.* 3. 9. ac proinde ſumma Angulorum *CBc*, *CDc*, hoc eſt Angulus *Dcd*, erit Momentum Anguli *ACD*, vel *ACB*, Anguli autem iſti *CBc*, *Dcd*, cum minimi ſint, ſunt inter ſe ut latera ſibi appoſita, ſive ut *ccD* vel *CD*, ad *BD*, hoc eſt, ut Segmenta Baſis reciproce. *Q. E. D.* Quod ſi Angulus uterque *B*, & *C*, fuerit acutus, eodem modo demonſtrabitur *Lemma* mutatis mutandis.

Corol Hinc conſequitur Momenta Angulorum ad Baſin eſſe inter ſe, ut ſunt Tangentes Angulorum ipſorum directe.

Hoc *Lemmate* muniti facili negotio cujuſvis *Iridis Diametrum*, vel Conſtructione Geometrica vel Calculo, obtinere licet. Expoſita enim Linea quavis recta *CA*, dividatur primum in *D*, ita ut *CA*, ſit ad *CD* in ratione *Refractionis*, quæ in aqua ſit, ut 250 ad 187, ſive acuratius ut 529 ad 396. Deinde dividatur *CA*, in *E*, ita ut *CE*, ſit ad *AE*, ut Unitas ad numerum *Reflectionum* quas patitur Radius *Solis*, ad *Iridem* propoſitam producendam idoneus; ac Diametro *AE*, deſcribatur Semicirculus *ABE*, ac Centro *C*, Radio *CD*, duc Arcum *BD*, Semicirculo *ABE*, in puncto *B*, occurrentem. Ductis denique rectis *CB*, *AB*, demittatur in *AB* productam Perpendicularis *CF*, eique parallela *EB*, Dico Angulum *CBF*, eſſe Angulum Incidentiæ, ac Angulum *CAB*, eſſe Angulum Refractum, quos quærimus, quique producent *Iridem* propoſitam.

Fig. 42.

Demonſtratio. Cum Triangula *ACF*, *AEB*, ſint ſimilia, erit *AF*, ad *BF*, ut *AC*, ad *EC*, hoc eſt ut numerus Reflectionum unitate auctus, ad unitatem per Conſtructionem; ac proinde Momentum Anguli *CBF*, erit ad Momentum Anguli *CAF*, in eadem ratione, per *Lemma præcedens*. Sed Sinus Anguli *CBF*, eſt ad Sinum Anguli *CAF*, in ratione Laterum *CA*, *CB*, hoc eſt in ratione Refractionis datæ, etiam per Conſtructionem. Angulus itaque Incidentiæ *CBF*, habet Angulum refractum, ſibi reſpondentem *CAF*, eorumque momenta ſunt in ratione propoſita, quocirca ſunt Anguli quæſiti, *Q. E. D.* Jamque multiplicando Angulum Refractum per Numerum Reflectionum unitate auctum, & è Facto ſubducendo Angulum Incidentiæ, habebitur Semiſſis Diſtantiæ Iridis a Sole, ſi Numerus Reflectionum fuerit par, vel a Solis Oppoſito ſi fuerit impar; prout jam diximus.

Hinc Conſtructione ſatis concinnâ nec ineleganti, omnium ordine *Iridum* Incidentias Synopticè exhibere poſſumus, in quolibet Liquore cujus *Refractio* cognita eſt. Si enim Linea expoſita *AC*, dividatur Bifariam in *E*, Trifariam in *e*, Quadrifariam in *ε*, ac Quinquifariam in *ν*, *&c.* ac Diametris *AE*, *Ae*, *Aε*, *Aν*, deſcribantur Semicirculi *ABE*, *Abe*, *Aβε*, *Avν*, Quibus omnibus occurrat Arcus Circularis *DBbβv* Centro *C*, Radio *CD*, deſcriptus (qui ſit ad *A C*, in ratione *Refractionis* data) in punctis *B*, *b*, *β*, *v*; dico quod ductæ lineæ *A B*, *A b*, *A β*, *A v*, conſtituent cum linea *A C* Angulos *CAB*, *CAb*, *CAβ*, *CAv*, æquales *Angulis Refractis*, ac cum Radiis *C B*, *C b*, *Cβ*, *Cv*, reſpective, Angulos æquales *Angulis Incidentiæ* requiſitis, nempe *ABC*, vel potius ejus complementum ad Semicirculum, pro *Primaria Iride*; *AbC*, pro *Secundaria*; *Aβ B*, pro *Tertia*, ac *Av C*, pro Quarta: & ſic deinceps.

Quod ſi cui Calculo accurato hos Angulos inveſtigare libeat, ex eodem fonte facile eruet Lector *Analyſta*, *quod poſito* Radio=1, ac Ratione *Refractionis ut r*, ad *s*, Sinus *Incidentiæ* erit $\sqrt{\frac{4}{3}\frac{1rr}{3ss}}$; Sinus vero *Anguli Refracti* $\sqrt{\frac{4ss}{3rr}\frac{1}{3}}$ a quibus Angulis provenit *Iris Primaria*. Pro *Secundaria* vero $\sqrt{\frac{9}{8}\frac{1rr}{8ss}}$ erit Sinus *Incidentiæ*, ac Sinus *Anguli Refracti* $\sqrt{\frac{9}{8}\frac{ss}{rr}\frac{1}{8}}$. Pro *Tertia*, Sinus *Incidentiæ* erit $\sqrt{\frac{16}{15}\frac{1rr}{15ss}}$. Sinus *Refracti Anguli* $\sqrt{\frac{16}{15}\frac{ss}{rr}\frac{1}{15}}$ Radii autem Lucis in *Iridem Quartam* Emergentes in guttulas *Incidunt* cum *Angulo cujus* Sinus eſt $\sqrt{\frac{25}{24}\frac{1rr}{24ss}}$: Angulus autem *Refractus* Sinum habet $\sqrt{\frac{25}{24}\frac{ss}{rr}\frac{1}{24}}$. & ſic de cæteris Invenies autem ſuſcepto Calculo admiſsa Ratione *Carteſiana*, *Iridem Primariam* diſtare ab Oppoſio *Solis* 41°. 30′; *Secundariam* 51°. 55′. ab eodem Oppoſito; *Tertiam* vero 40°. 20′; ac *Quartam* 45°. 33′. ab ipſo *Sole*; quas neſcio an unquam aliquis videre poſſit ob Lumen *Solis* in ſingulis *Reflexionibus* ac *Refractionibus* magis magiſq; attenuatum. Atq; hæc de *Magnitudine Iridum* in Guttulis perſpicuis Fluidi, cujus Vires *Refractivæ* innoteſcant, dicta ſunto. Reſtat ut nonnulla adjiciam de *Coloribus* quibus pinguntur *Irides* eorumque ordine in ſingulis, variato ſcilicet *Refractione* per omnes Gradus poſſibiles.

Sciendum autem in primis, *Lumen* omne generis *Cærulei* paulo plus *Refringi* quam Lumen quodvis *Rubens*, à qua differentia oritur Latitudo *Iridum*, obſervatione quidem ægre definienda, ob incertos *Colorum* in Nube limites. Quo autem majoris eſt inæqualitatis Ratio inter *C A*, & *C D*, ſive quo major eſt *Refractio* eo major provenit Diſtantia *Iridis* cujuſvis a *Sole*, adeoque ſemper *Iridum* limites a *Sole* remotiores *Purpureo colore* fulgent, propiores vero ipſiſſe *Rubent*: Uti ſemper videre eſt in *Iride Primaria*, quæ quidem evaneſcit in *Oppoſito Solis*, ſic Sinus *Incidentiæ* fuerit ad Sinum *Anguli Refracti* ſicut *C A*, ad *C E*, ſive ut 2, ad 1. Quod ſi major fuerit Ratio illa, nulla omnino conſpici poteſt *Iris Primaria*.

Vid. Sup. Vol. I. Cap. III. §. 1.

Secundariam autem *Iridem* notandum eſt in *Oppoſito Solis* in punctum abire quoties Ratio *Refractionis* fuerit ut 1, ad 0, 847487... Inde vero ad *Solem* ipſum recurrere, ibique evaneſcere, ſi dicta Ratio fuerit ut 3 ad 1, ſive ut *C A*, ad *Ce*. Intermediis vero Rationibus (quales habentur in omnibus Fluidis notis, Aere excepto) quo major eſt Ratio eo plus diſtat *Iris* ab *Oppoſito Solis*, vel potius a *Sole* ipſo, numerato ultra Semicirculum Arcu: ac proinde *colores* diverſo a *Primaria* ordine reperiri videbuntur, in his recurſibus niſi hoc in ſenſu ſumatur diſtantia *Iridum* a *Sole*: quod quidem ubique in cæteris obſervandum.

Tertia Iris in *Oppoſito Solis* confunditur, exiſtente Ratione *Refractionis* ut 1 ad 0,91855... Indeque ad *Solem* recurrit in Ratione 1, ad 0,6825... Unde iterum, reſtituto Colorum ordine, in Ratione 4, ad 1, ſive ut *C A*, ad *C t*, deſinit in *Solis Oppoſito*. *Iris* autem *Quarta* a *Sole* incipiens in Ratione æqualitatis, ad *Oppoſitum* ejus tranſit in Ratione 1, ad 0,94895 ... indeque ad *Solem* regreditur, ſi Ratio fuerit ut 5, ad 4. Hinc iterum ſpargitur ad *Solis Oppoſitum* in Ratione 1, ad 0,56337 ... quo ſpatio clauduntur omnium Fluidorum *Refractiones* notæ. Denique Ratione exiſtente ut 5, ad 1, ſive ut *C A*, ad *C n* in ipſo *Sole* evaneſcit. Coloribus ubique quo ad viſum inverſis in regreſſu ad *Solem*, uti rectis in Egreſſu.

Hinc in Nimbis Aqueis, *Primaria* ac *Quarta Iris Coccineos Colores Soli* objiciunt, *Secundaria* vero ac *Tertia Purpureos*.

Unde autem oriatur diverſa Fluidorum *Vis Refractiva*, non levis momenti Problema eſt, interque Arcana Naturæ nondum ſenſibus nec Ratiociniis noſtris objecta merito cenſendum: *Aqua* ebonim Pura, inter Fluida omnium minime Radios Lucis *Refringit*; ac Salibus quibuſvis ſolutis imbuta, ſecundum quantitatem Salis Ponduſque ſuum, auget *Refractiones:* ac *Spiritus Corroſivi* Aqua multo graviores, etiam radios Lucis multo plus *Detorquent*; nec mirum quum Corpora Denſiora ſint, eoque magis Luminis tranſitus obſtruere concipi poſſunt: Cur autem in *Spiritibus Ardentibus* aut *Oleis* quibuſvis reperiatur tanta *Refractio*, præſertim in *Sp. Terebinthinæ* aut *Vini* cum Fluida ſint reſpectu *Aquæ* admodum Levia, ac particulis æthereis plurimum Conſtantia pari argumento non patet; Sed Luminis ac Materiæ ipſius interiorem cognitionem poſtulare videtur.

Ex data autem *Iridis* a *Sole* diſtantia *Refractionis* Rationem eruere, Curioſis Anſam præbet obſervandi accuratiſſime ac parvo negotio cujuſvis Fluidi *Refractiorem:* Si enim ab inferiori parte exilis Cannulæ Vitreæ dependeat Guttula alicujus Fluidi perſpicui, ac *Sole* prope Horizontem conſtituto, ſed fortiter ſplendente, obſervetur ſub quo Angulo cum *Oppoſito Solis* in Guttula conſpiciantur *Iridis Colores*, habebitur levi Calculo Ratio quæſita: *Cubica* autem eſt *æquatio*, unica radice explicabilis, qua ex data *Iride Primari* ſupputatur ratio; nempe $T^3 ——— 3\,TTt \;\ldots\; 4\,rrt = 0$, ubi T, eſt Tangen *Anguli Incidentiæ* requiſitæ; t autem, Tangens ſemiſſis diſtantiæ *Iridis* ab *Op poſito Solis* ad radium $r = 1$: Unde juxta Cardani regulas, provenit *Theorem* viz *De Cubo ipſius* t, *Subducatur Productum ex* $2\,tr$ *in exceſſum Secantis ejuſde arcus ſupra Radium: Differentia erit Cubus minor... Eorundem autem ſumma,* a*jectis* $4\,trr$ *erit Cubus major. Summa Laterum utriuſque Cubi atque ipſius r æquabitur Tangenti Anguli* Incidentiæ, *ejuſque ſemis erit etiam Tangens* Angu Refracti unde conſtat ratio quam quærimus.

Hujus rei cape Exemplum In Guttula *Olei Terebinthinæ* obſervatur di ſtantia *Iridis Primariæ* ab *Oppoſito Solis*. 25°. 40′ quæritur Ratio *Refractioni*

$$t = \textit{Tang.}\ 12^\circ.\ 50'. = 0{,}2278.63$$
$$s = \textit{Secant. ejuſdem} = 1{,}0256197$$

$$ttt = 0{,}01181217$$
$$s - r \text{ in } 2tr = 0{,}01167265$$

Diſ

Diff. Cubus minor. 0,00014952. $\sqrt[3]{}$ 0,0530773

Summa 0,02349482
$4trr$ 0,91122525

Cubus major 0,93472007 $\sqrt[3]{}$ 0,9777486
t 0,2278063

T = Tang. *Incid.* 51°. 32′ 1,2586322
$\frac{1}{2}T$ = Tang. *Refr.* 52. 11. 0,6293161

Denique ut $\sqrt{TT+4}$, ad $\sqrt{TT+1}$ :: ita r, ad s :: ita 1, ad 0,68026. Quæ quidem ratio proxime accedit ad illam, quam in *Vitro* ac plurimis Solidis pellucidis Experimento ineſſe conſtat: *Adamas* autem non tantum Duritie ac pretio Diaphana omnia præcellit, ſed etiam hac *Vi Refractiva*, cum ſit ratio ejus ut 5, ad 2, proxime, vel rectius ut 100 ad 41. Sed de his fortaſſe ſuo loco uberius.

Dum in his ſcribendis occupatus tenerer, meo hortatu peritiſſimus Geometra, *Dominus de Moivre* ſimilem *æquationem* pro inveſtiganda ratione è data *Iridis Secundariæ* Semidiametro inquiſivit: qua quidem paulo accuratius determinatur Ratio, ſed cum Biquadratica ſit, pari facilitate Calculus non abſolvitur: Hæc autem eſt $T^4 + \frac{2}{3}T^3 t\, 2TTrr - \frac{1}{4}r^4 = 0$. Ubi T, eſt Tangens *Anguli Refracti*; t, Tangens ſemiſſis diſtantiæ *Iridis* ab *Oppoſito Solis* ad radium $r = 1$. Hæc autem *Æquatio* ejus formæ eſt, ut ſemper Affirmativa una ac una Negativa radice explicari poſſit, quarum altera ac Minor eſt Tangens *Anguli Refracti* in regreſſu ad *Solem*, *viz.* cum *Purpurei Colores Soli* propiores ſunt. Major autem radix eſt Tangens *Anguli Refracti*, in *Iride* a *Sole* egrediente, ut ſupra obſervavimus; nempe in Fluido minoris rationis. In *Oleo Terebinthinæ* obſervatur diſtantia hujus *Iridis* ab *Oppoſito Solis* 81°. 30′; unde eruere poteſt Lector Curioſus radices 0, 80822.. ac—2, 9831.. Tangentes *Angulorum Refractorum*; hinc ſupputatur ratio majoris inæqualitatis ut 1, ad 0,67995.. qualis eſt in *Oleo Terebinthinæ*: A Majori autem radice provenit ratio minor, ut 1, ad 0,9540.. proxime, quanta datur in Fluido *Iridem Secundariam* ejuſdem Diametri exhibente, ſed quæ *Inhærentibus Coloribus* more *Primariæ Solem* reſpiceret.

LXX. *A.* 1679. in *Maio*, juxta Civitatem *Jounkoping* in colle quodam altiori, cui ad ſpatium quadrantis Milliaris ſubjacet Lacus aqua dulci *Wetter* dictus. in cujus Superficie tum placidiſſima, nulla Ventorum Vi agitata, repræſentabatur mihi Inſula *Wiſingsburg*, in eo Lacu ſita tam vivide, ut a peritiſſimo Pictore melius vix depingi poſſet; Feneſtras enim & Homines, cujus eſſent Sexus, diſcerni potui; cum tamen ipſa Inſula in aſpectum meum nondum pervenerat, propter interjacentes Colles, & diſtabat a me per tria Milliaria cum Quadrante ad minimum ubi decem Milliaria *Suecica* ſufficiunt fere unum *Gradum*. Erat tum temporis Sol primum Ortus, & Oculus meus inter locum iſtum in Lacu, ubi hæc repræſentabantur, & So-

A Strange Appearance near Upſal; By Dr, And. Spole, *Ph. C.* n. 5 p. 146.

lem ſe.

lem; ab hoc loco dum digrederer, nihil tale in Lacu viſum eſt; ſicut & altera Die cum ad eundem Locum me contuli eodem tempore, tale quid non comparuit, neque Lacus tanta *Halcyonia erat*.

An unuſua' Me cor; *By* *D*r. Wallis, n. 135. p. 863.

LXXI. *Sept* 20. 1676. about 7 of the Clock at Night, or ſoon after, there appeared a ſudden *Light*, equal to that of Noon-day; ſo that the ſmalleſt Pin or Straw might be ſeen lying on the Ground. And above in the Air, was ſeen (at no great diſtance as was ſuppoſed) a long appearance as of *Fire*; like a long Arm (for ſo it was deſcribed to me) with a great Knob at the end of it; ſhooting along very ſwiftly: And at its diſappearing, ſeem'd to break into ſmall Sparks or Parcels of *Fire* like as *Rockets* aad ſuch *Artificial Fire-works*, in the Air are wont to do. 'Twas ſo ſurpriſing, and of ſo ſhort continuance, that it was ſcarce ſeen by any who did not then happen to be abroad. I am told, by ſome, that it ſcarce continued longer than while one might tell 15 or 20 at the moſt; which will be leſs than half a Minute. All this might happen well enough from ſome *Fiery Meteor* in our Air; as a *Draco-Volans* (as ſome have been pleaſed to call this) or the like. But that which makes it to me the more ſurpriſing it this, that I find the ſame to have been ſeen in moſt Parts of *England*, and at or near the ſame time: As, not only at *Oxford* and in *Oxfordſhire*, but alſo in *Northamptonſhire*, *Glo* *ceſterſhire*, *Worceſterſhire*, *Somerſetſhire*, *Devonſhire*, *Hampſhire*, *Suſſex*, *Surrey*, *Kent*, *Eſſex*, and (particularly) by the Watermen on the *Thames*, in their paſſage between *Graves end* and *London*.

This is a great breadth of Ground, and too much for any Ordinary *Me* *teor* in our lower Region of the Air, to be ſeen in at once; which Ar gues, that either it was higher than it was imagined to be (though th Light of it reached the Earth,) or elſe, that it had a very Swift Motio This made me then conjecture that it might be ſome ſmall Comet, who *Linea Trajectoria* paſſed very near our Earth, or upon it: And might, wh further diſtant from us, appear as a Comet. And that Comet which ha ſince appeared in *April* and *May* confirms me in the ſame opinion; whi I conjecture may be the very ſame which paſſed by us in *September* la Why it was not ſooner ſeen, I cannot tell; ſave what is the common fa of moſt Comets, that they are ſeldom obſerved till after their neareſt di ſtance from us: And, perhaps, it may have been ſo near the *Sun* (as to i viſible place) as not to be much above our *Horizon* ſave in the day tim And for the like reaſon it may be, that in *September* laſt when it paſſ by us, it was not more ſeen abroad in other Parts; it might paſs the in the Day time, being but in the Twy-light with us and, had it been o hour ſooner, the Day-light would have hindred us from ſeeing it. Whi way its motion was when near us, I cannot conclude, ſo as to ſatisfie m ſelf. For moſt that ſaw it, being ſuddenly ſurpriſed, took little more no tice of it, than that it ſuddenly appeared, and was ſuddenly gone, but ſa it ſo little time as ſcarce to mark which way. By the account I had from o in *Northamptonſhire* (between *Brackly* and *Banbury*) it ſhould ſeem to hav moved there towards the South-weſt. By the account I had from one wh ſaw it in *Hampſhire* (between *Wincheſter* and *Southampton*) it ſhould ſeem t

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be towards the South-eaſt; from others I have nothing of certainty, and therefore can conclude nothing. Its Motion might then ſeem to us the ſwifter, if its proper Motion were then one Way, and the Earth's Motion here, at the ſame Time, contrary to it. And it is not impoſſible that its daſhing againſt the Earth might diſturb its Motion; as when Clouds in their Paſſage meet with Mountains.

LXXII. 1. Some Members of the *R. Society* did, with two different ſorts of Inſtruments, make divers Experiments for finding the Proportions of the Compreſſion of Air under Water, in the Month of *July* at *Sheerneſs*, in the Mouth of the River of *Medway*, at the time of high Water, where the Depth was then about 19 Fathom, and the Proportion of the Weight of the *Salt-water* to that of the ſame Quantity of Freſh Water, taken out of the River *Thames*, was as 41 to 42.

The Compreſſion of Air, under Water, by M. . . . n. 73. p. 2192.

One of the Inſtruments was a Glaſs-Bottle, that held a Quart of Water, having a braſs Ring faſtned to the Mouth of it, with a *Valve*, or Flap, that opened inward, ſo well fitted, that the Bottle being fill'd more or leſs with Water, none dropped out tho' forcibly ſhaken. This, let down 33. Foot into the Water, the Mouth downwards, and after a little ſtay drawn up, was found to be ſo very near half full of Water, at ſeveral Tryals, that it was thought fit to ſtate the Compreſſion of Air at that Depth to that Meaſure.

The Quantity of *Compreſſion* was known by weighing the Bottle with the Water in it, after that a forcible Depreſſion of the Flap had made way for the Eruption of the compreſt Air (which kept it up even when the Bottle was placed with the Mouth upwards,) and then filling the Bottle full of the ſame water, and weighing it again; and laſtly, by weighing the Bottle after the water was all let forth; the weight whereof being deducted, the firſt Quantity of water weigh'd juſt half as much as the ſecond, or ſo near it that the Fraction was not conſiderable. Whence it was concluded, that the Quantity of the Air, that filled the Bottle before it was immerſed in the Water, was at the Depth of 33 Feet, compreſſed into half the ſpace it took up before, and ſo proportionably at other Depths

The other Inſtrument was a Cylinder of Glaſs, ſome 2 Foot long, cloſe at one End, and having the other end drawn ſmall with a Lamp, and turn'd down a little way, after the manner expreſſed in the *Figure*. This Cylinder was immerſed perpendicularly with the crooked end uppermoſt, by which, as it ſunk in the water, the Preſſure thereof did gradually force in ſo much water as compreſt the Air proportionably to every depth, till the Cylinder was ſo far immerſed, that the hole in the crooked part of it was juſt 33 Feet under Water; and then it being drawn up by meaſuring from the Bottom of the Cylinder to the height of the hole in the crooked part, by a pair of Compaſſes, the Water was found to fill the Cylinder ſo near the half, that the Motion of the Superfice of the Water, and the Minuteneſs of the difference being conſider'd, it was thought fit to ſtate it to juſt half.

Fig. 45.

According to theſe Experiments confirmed by Tryals at other Depths, the enſuing Table was computed.

The Proportion of the Weight of Salt Water to that of Freſh, was found by weighing ſome Ounces of both in a Bottle, whereof the Weight was exactly known, and which was made with ſo ſmall a Neck, that the Addition or Diminution of one ſingle Drop in it was diſcernable.

n.75.p.2240 The Table is on theſe Grounds computed, upon the ſuppoſed Depths from the Surface of the Water to the Bottom of the Air included in a Cylinder of 60 inches, cloſed at one End, and having the open end downwards.

Depths in *Water.*		*Air compreſt*, to		*Depth* in *Water.*		*Air compreſt*, to	
Feet.	*Fathoms*	*parts.*	*Inches.*	*Feet.*	*Fathoms*	*parts.*	*Inches.*
00	00	1	60	32	0	$\frac{33}{65}$	$30\frac{30}{65}$
1	0	$\frac{33}{34}$	$58\frac{4}{17}$	33	$5\frac{1}{2}$	$\frac{1}{2}$	30
2	0	$\frac{33}{35}$	$56\frac{4}{7}$	66	11	$\frac{1}{3}$	20
3	$\frac{1}{2}$	$\frac{33}{36}$	55	99	$16\frac{1}{2}$	$\frac{1}{4}$	15
4	0	$\frac{33}{37}$	$53\frac{19}{37}$	132	22	$\frac{1}{5}$	12
5	0	$\frac{33}{38}$	$52\frac{2}{19}$	165	$27\frac{1}{2}$	$\frac{1}{6}$	10
6	1	$\frac{33}{39}$	$50\frac{10}{13}$	198	33	$\frac{1}{7}$	$8\frac{4}{7}$
7	0	$\frac{33}{40}$	$49\frac{1}{2}$	231	$38\frac{1}{2}$	$\frac{1}{8}$	$7\frac{1}{2}$
8	0	$\frac{33}{41}$	$48\frac{2}{41}$	264	44	$\frac{1}{9}$	$6\frac{4}{6}$
$8\frac{1}{4}$	0	$\frac{4}{5}$	48	297	$49\frac{1}{2}$	$\frac{1}{10}$	6
9	$1\frac{1}{2}$	$\frac{33}{42}$	$47\frac{1}{7}$	339	55	$\frac{1}{11}$	$5\frac{5}{11}$
10	0	$\frac{33}{43}$	$46\frac{2}{43}$	363	$60\frac{1}{2}$	$\frac{1}{12}$	5
11	0	$\frac{33}{44}$	45	396	66	$\frac{1}{13}$	$4\frac{8}{13}$
12	2	$\frac{33}{45}$	44	429	$71\frac{1}{2}$	$\frac{1}{14}$	$4\frac{2}{7}$
13	0	$\frac{33}{46}$	$43\frac{1}{23}$	462	77	$\frac{1}{15}$	4
14	0	$\frac{33}{47}$	$42\frac{6}{47}$	495	$82\frac{1}{2}$	$\frac{1}{16}$	$3\frac{3}{4}$
15	$2\frac{1}{2}$	$\frac{33}{48}$	$41\frac{1}{5}$	528	88	$\frac{1}{17}$	$3\frac{9}{17}$
16	0	$\frac{33}{49}$	$40\frac{20}{49}$	561	$93\frac{1}{2}$	$\frac{1}{18}$	$3\frac{1}{3}$
$16\frac{1}{2}$	0	$\frac{2}{3}$	40	594	99	$\frac{1}{19}$	$3\frac{3}{19}$
17	0	$\frac{33}{50}$	$39\frac{3}{5}$	627	$104\frac{1}{2}$	$\frac{1}{20}$	3
18	3	$\frac{33}{51}$	$38\frac{42}{51}$	660	110	$\frac{1}{21}$	$2\frac{6}{7}$
19	0	$\frac{33}{52}$	$38\frac{1}{13}$	693	$115\frac{1}{2}$	$\frac{1}{22}$	$2\frac{8}{11}$
20	0	$\frac{33}{53}$	$37\frac{19}{53}$	726	121	$\frac{1}{23}$	$2\frac{14}{23}$
21	$3\frac{1}{2}$	$\frac{33}{54}$	$36\frac{2}{3}$	759	$126\frac{1}{2}$	$\frac{1}{24}$	$2\frac{1}{2}$
22	0	$\frac{33}{55}$	36	792	132	$\frac{1}{25}$	$2\frac{2}{5}$
23	0	$\frac{33}{56}$	$35\frac{5}{14}$	825	$137\frac{1}{2}$	$\frac{1}{26}$	$2\frac{4}{13}$
24	4	$\frac{33}{57}$	$34\frac{42}{57}$	858	143	$\frac{1}{27}$	$2\frac{2}{9}$
25	0	$\frac{33}{58}$	$34\frac{4}{29}$	891	$148\frac{1}{2}$	$\frac{1}{28}$	$2\frac{1}{7}$
26	0	$\frac{33}{59}$	$33\frac{33}{59}$	924	154	$\frac{1}{29}$	$2\frac{2}{29}$
27	$4\frac{1}{2}$	$\frac{33}{60}$	33	957	$159\frac{1}{2}$	$\frac{1}{30}$	2
28	0	$\frac{33}{61}$	$32\frac{28}{61}$	990	165	$\frac{1}{31}$	$1\frac{29}{31}$
29	0	$\frac{33}{62}$	$31\frac{26}{31}$	1023	$170\frac{1}{2}$	$\frac{1}{32}$	$1\frac{9}{16}$
30	5	$\frac{33}{63}$	$31\frac{3}{7}$	1056	176	$\frac{1}{33}$	$1\frac{9}{11}$
31	0	$\frac{33}{64}$	$30\frac{15}{16}$	1089	$181\frac{1}{2}$	$\frac{1}{34}$	$1\frac{13}{17}$

Depths in Water.		Air Compreſt, to		Depths in Water.		Air Compreſt, to	
Feet.	Fathoms.	parts.	inches.	Feet.	Fathoms.	parts.	inches.
1122	187	$\frac{1}{35}$	$1\frac{5}{7}$	1551	$258\frac{1}{2}$	$\frac{1}{48}$	$1\frac{1}{4}$
1155	$192\frac{1}{2}$	$\frac{1}{36}$	$1\frac{2}{3}$	1584	264	$\frac{1}{49}$	$1\frac{11}{49}$
1188	198	$\frac{1}{37}$	$1\frac{23}{37}$	1617	$269\frac{1}{2}$	$\frac{1}{50}$	$1\frac{1}{5}$
1221	$203\frac{1}{2}$	$\frac{1}{38}$	$1\frac{11}{19}$	1650	275	$\frac{1}{51}$	$1\frac{9}{51}$
1254	209	$\frac{1}{39}$	$1\frac{7}{13}$	1683	$280\frac{1}{2}$	$\frac{1}{52}$	$1\frac{2}{13}$
1287	$214\frac{1}{2}$	$\frac{1}{40}$	$1\frac{1}{2}$	1716	286	$\frac{1}{53}$	$1\frac{7}{53}$
1320	220	$\frac{1}{41}$	$1\frac{19}{41}$	1749	$291\frac{1}{2}$	$\frac{1}{54}$	$1\frac{1}{9}$
1353	$225\frac{1}{2}$	$\frac{1}{42}$	$1\frac{3}{7}$	1782	297	$\frac{1}{55}$	$1\frac{1}{11}$
1386	231	$\frac{1}{43}$	$1\frac{17}{43}$	1815	$302\frac{1}{2}$	$\frac{1}{56}$	$1\frac{1}{14}$
1419	$236\frac{1}{2}$	$\frac{1}{44}$	$1\frac{4}{11}$	1848	308	$\frac{1}{57}$	$1\frac{1}{19}$
1452	242	$\frac{1}{45}$	$1\frac{1}{3}$	1881	$313\frac{1}{2}$	$\frac{1}{58}$	$1\frac{1}{29}$
1485	$247\frac{1}{2}$	$\frac{1}{46}$	$1\frac{7}{23}$	1914	319	$\frac{1}{59}$	$1\frac{1}{59}$
1518	253	$\frac{1}{47}$	$1\frac{13}{47}$	1947	$324\frac{1}{2}$	$\frac{1}{60}$	1

2. Let *E D*, repreſent the *Tube*$=x$.

A B, the Diſtance of the upper part of the *Tube* from the Surface of the Water, above or under it$=b$.

The Calculation by M.. n.75.p.2239 Fig. 44.

FC, the Depth of the Water from its Surface to the bottom of the Air within the *Tube*$=a$.

C, that part of it, which remains fill'd with Air, within the Water.

D, the reſt thereof which is full of Water.

any two of the three firſt, x, b, and a, being given, the other is wn ; and conſequently the reſt alſo.

, if by the Incumbent Weight of 33 Feet Depth in Water, the Air in *Tube* is Compreſt into Half the ſpace it filled before, then the ſaid 33 Depth of Water equals the Weight, or *Preſſure*, of the Incumbent Air Surface of the Water. Now, as the Weight, or *Preſſure*, of the Air *Surface* of the Water ; is to the Depth of the Water, from the Surthereof to the bottom of the Air within the *Tube*: So is the Length of *Tube* fill'd with Air, to the Length thereof fill'd with Water. That is, rding to the ſaid Experiments, putting z for 33, or whatever, at other or places, ſhall be found to be the Weight, or *Preſſure*, of the Incum- Air on the Surface of the Water, (for it is not always the ſame ex-;) $z : a :: a+b : \frac{a^2 \times ab}{z} = CD$.

$$\text{And therefore } \frac{a^2+ab+za+zb}{z}=x.$$

$$\text{Wherefore } \frac{z}{z+a}x-a=b.$$

$$\text{And } \overline{bb+zb+zz+zx}+b-z=a.$$

Therefore *a* and *b*, being given, *x* is known by the *Firſt Equation*; And, *a* and *x*, being given, *b* is known by the *Second*; and *b* and *x* being given *a* is known by the *third*.

The Horizontal Line *BFB AF*, is ſubſtituted for *G A B E F b*, when the *Cloſe* end of the *Tube* is not even with the Surface of the *Water*, to avoid the Breach $c\,C = b\,B = \frac{1x}{4}\,b^2$, in the Length of the *Tube*.

Effects of the Varying Weight of *the* Atmoſphere *upon Bodies* Water; *By* Mr. Rob. Boyle, n. 91. p. 5156.

LXXIII. I cauſed to be blown at the Flame of a Lamp three ſmall round Glaſs-Bubbles, about the bigneſs of Hazel-nuts, and furniſhed each of them with a ſhort and Slender *Stem*, by whoſe means they were ſo nicely *Poiſed* in *Water*, that a very ſmall Change of Weight would make them either Emerge, if they but lightly leaned on the Bottom of the Veſſel, or Sink, if they floated on the Top of the Water. This being done at a time when the *Atmoſphere* was of a convenient Weight, I put them in a wide-mouth'd Glaſs furniſh'd with common Water, and leaving them in a quiet place, where yet they were frequently in my Eye, and were ſuffer'd to continue many Weeks (or ſome Months) I obſerved, as I expected, that ſometimes they would be at the *Top* of the *Water*, and remain there for divers Days, or perhaps Weeks; and ſometimes would fall to the Bottom, and after having continued there for ſome time (longer or ſhorter) they would again Emerge. And though ſometimes (eſpecially if I removed the Veſſel that contain'd them to a Southern Window) they would riſe to the *Top* or fall to the Bottom of the Water, according as the *Air* was *Hot* or *Cold*; yet 'twas not difficult to diſtinguiſh theſe Motions from thoſe produced by the *Varying Gravity* of the *Atmoſphere*. For when the Beams of the Sun, or *Heat* of the Ambient *Air*, by rarefying the *Air* included in the *Bubbles*, made that *Air* drive out ſome of the *Water*, and conſequently made the whole Bubble (conſiſting of *Glaſs*, *Air* and *Water*) ſomewhat Lighter than a bulk of Water equal to it, though the Bubble did neceſſarily Swim as long as the included Air was thus *Rarefied*, yet when the Abſence of the Sun, or any other Cauſe made the Air loſe its Adventitious Warmth, there would enſue a *Condenſation* of the Air again, and thereupon an Intruſion of more Water (to ſucceed the Air) into the Glaſs, and conſequently a ſinking of the Bubble, and this would commonly happen at Night, if it did not happen ſooner. But when it was upon the account of the varying Weight of the *Atmoſphere* that the Bubbles either roſe or fell, it appeared by the *Bar* *ſcope*, that the *Atmoſphere* was ſo Heavy or ſo Light, that they ought to do ſ Inſomuch that I divers times predicted whether I ſhould find the *Mercury* i the *Baroſcope* high or low, by obſerving the Situation and Poſture of th Bubbles; and conſulting that Inſtrument, it verified my Conjectures. An though whilſt the *Atmoſphere* was not too conſiderably either Light or He vy, the Changes of the Air as to Heat or Cold, would (as I was ſaying place the Bubbles ſometimes at the Top, and ſometimes at the Bottom the Water, within the Compaſs of a Day; yet if the *Atmoſphere* were eith very Heavy or very Light, the Bubbles would continue at the Bottom at the Top of the Water for many Days together, in Caſe the *Atmoſpher* did not in all that time Change its *Gravity*. And I remember, that I di

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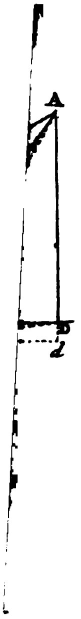


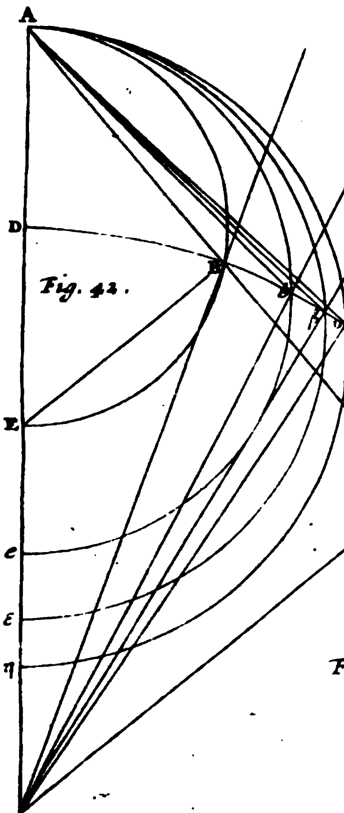


Fig. 42.

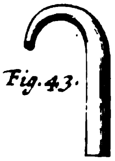


Fig. 43.

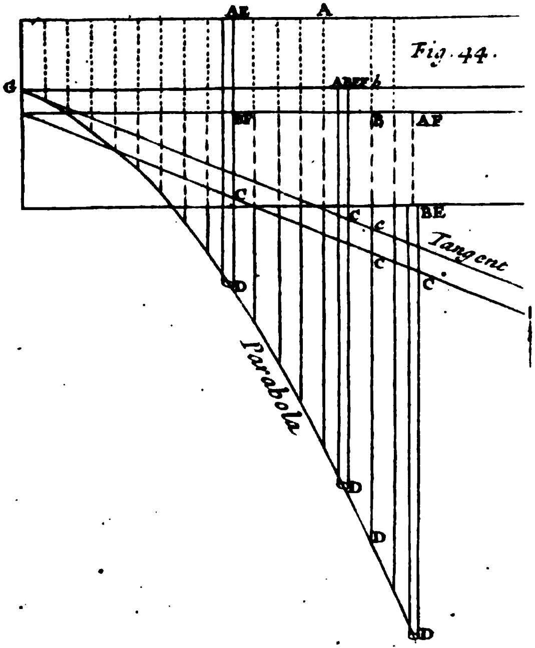
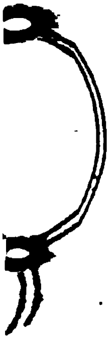


Fig. 44.



To take Exhausted Receivers away from the Air-Pump; By M. Papin, n. 120. p. 497.

n. 121. p. 544.

Effects of t
Varying
Weight of
the Atmo-
ſphere *upo*
Bodies Wat
By Mr. Rob
Boyle, n. 9
p. 3156.

for Curioſity's ſake, when the Quick-ſilver was high in the *Baroſcope*, put the Glaſs two or three Days in a South-Window about Noon (and for a good while after) and that in Sunſhining Weather, and yet even then the Bubbles did not Emerge, though it appeared by a good *Seal'd Weather-Glaſs*, which I kept in the ſame Window, that the Ambient Air was much Warmer than at other times, when I had obſerved the Bubbles to keep at the Top of the Water.

N. B. 1. It being very difficult to *Poiſe* ſeveral Bubbles preciſely, as well one as another, I thought it not ſtrange, that all the three Bubbles did not conſtantly (though for the moſt part they did) riſe and fall together, but ſometimes two of them, and now and then (though ſeldom) one alone, would Sink or Emerge, when the Change of the Weight of *Atmoſphere* was not conſiderable enough to Operate ſenſibly upon the reſt. And therefore 'tis not amiſs to *Poiſe* a great Number of Bubbles together, that after tryal made of all, the fitteſt may be choſen. For I have obſerved it ſometimes to happen, that a Bubble that floated when 'twas firſt *Poiſed*, would after a while Subſide, without any manifeſt cauſe, or if it were made to Sink by ſuch a Cauſe, it would continue at the bottom of the Water, though that Cauſe were removed; which difficult *Phænomenon* ſeeming to depend upon a kind of Imbibition made of certain particles of an Aerial Nature by the Water, the Conſideration of it belongs to another place, not to this; where it may ſuffice, that the Experiment did ſometimes actually anſwer Expectation, as that above related did; wherein my main Drift was to ſhew, that ſince, as the *Atmoſphere* is Heavier or Lighter, 'tis capable to work upon Bodies under Water, ſo as to procure their Sinking, or their Emerſion; the Air (though a Fluid a thouſand times Lighter) muſt lean or preſs upon the *Water* it ſelf, by whoſe Intervention it produces theſe Effects, which confirms what I elſewhere Teach, that the *Atmoſphere* is Incumbent, as a Heavy Body, upon the *Terraqueous Globe*.

LXXIV. I cauſed the Edges of my *Recipient* to be well Ground, ſo as that being apply'd, it every where touched a Glaſs Plate, which had alſo been very ſmoothly Ground to ſerve for a *Cover* to the ſame; and I ſpread a piece of *Lamb-Skin* wetted, over the ſaid Plate, and having thus applyed it to the *Engine*, I put my *Recipient* over it: But in one place there was a Hail-ſhot of Lead, which kept the *Receiver* from being exactly applyed to its Cover, that ſo the Air might more freely get out. And having afterwards whelmed another great *Receiver* over all, I cauſed the *Pump* to be plyed. All being well *Evacuated*, I ſhook the *Engine* ſo as that the little *Receiver* fell off from the Hail-ſhot, and ſtood every where cloſe to the Skin, expanded over the Cover of the Glaſs plate. Then I had no more to do but to ſuffer the Air to re-enter into the great *Receiver*, and this Air preſſing upon the little one, kept it ſo cloſely faſtened to its Cover, that it was impoſſible for me to ſever them. And I am aſſured, that the Air enters not into the ſmall *Receiver*, when 'tis thus applied upon the Skin; for I have often put *Gages* in them, which always kept at the ſame height, altho' the Air was permitted to re-

paſs.

To take Exhausted Receivers away from the Air Pump; By M. Papin, n. 120. p. 477.

n. 121. p. 544.

paſs into the great *Receiver*. You might alſo let alone the putting under of the Hail-ſhot to keep up the little *Recipient*, becauſe the *Air* by its *Spring* would lift it up ſufficiently; but then the *Vacuum* would not be ſo perfectly made.

When I firſt began to keep *Receivers* thus *Void* of *Air*, I apply'd *Eels-Skins* to the Cover. But I found them not proper for things that are intended to be conſerved a long time, becauſe by Drying they grow *Springy*, and this *Spring* is capable to raiſe the whole Pillar of *Air* that preſſes the *Receiver* againſt its Cover; and ſo the Air gets in between, and fills the place Exhauſted.

Afterwards I employed *Mutton-Skins*; but that ſticks yet leſs cloſe than an *Eel-Skin*: For, as ſoon as the External Air comes to preſs upon it, it makes all the *Water*, which Wetteth the Skin, that ſtands over without, enter into the emptied *Receiver*; and you may ſee little Drops of Water coming out of the Pores of the Skin that is under the *Receiver*; and after the Water is all entered, the Air quickly gets in the ſame way.

At length I took a *Lamb-Skin*, and by means thereof I have kept *Receivers* empty 8 Days together, and never perceived it fail. Yet, for greater ſecurity, I do put *Turpentine* round about ſuch *Receivers* as I mean to keep ſtaunch a long time. Mean while, this Difference betwixt the Skins of *Mutton* and *Lambs* is ſomewhat remarkable, and confirms what *Phyſicians* ſay of the different Conſtitution of Bodies in *Youth* and *Old-Age* I afterwards found that Paper wetted ſerves as well as a Lamb-Skin; but you muſt put *Turpentine* about it before it be dry.

Seeds *Sown in the* Exhauſted Receiver; *By* .... n. 23. p. 425.

LXXV. Some *Lettice* Seed being Sown upon ſome Earth in the Open Air, and ſome of the ſame Seed at the ſame time upon other Earth in a Glaſs Receiver of the *Pneumatick Engine*, afterwards Exhauſted of Air, the Seed expoſed to the Air was grown up an Inch and a half high, within 8 Days: But that in the Exhauſted Receiver, not at all. And, Air being again admitted into the ſaid Emptied *Receiver*, to ſee whether any of the Seed would then come up, it was found, that in the ſpace of one Week it was grown up to the height of two or three Inches.

Experiments concerning the Relation between Light *and* Air (*in* Shining Wood *and* Fiſh;) *By* Mr. Rob. Boyl, n. 31. p. 581.

LXXVI. *Exp.* I. *Oct.* 29. 1667. Having procured a piece of *Shining Wood*, about the bigneſs of a Groat or leſs, that gave a Vivid Light (for *Rotten-Wood*) we put it into a middle-ſized *Receiver*, ſo as it was kept from touching the Cement; and the *Pump* being ſet a-work, we obſerved not, during the 5 or 6 firſt Exſuctions of the Air, that the Splendour of the included Wood was manifeſtly leſſened (though it was never at all increaſed; but about the 7th Suck, it ſeem'd to grow a little more Dim, and afterwards anſwered our Expectation, by loſing of its Light more and more as the Air was ſtill further Pumped out; till at length about the 10th Exſuction (though by the removal of the Candles out of the Room, and by black Cloaths and Hats we made the place as dark as we could, yet) we could not perceive any Light at all to proceed the *Wood*.

Exp. II. Wherefore we let in the outward Air by Degrees, and had the pleaſure to ſee the ſeemingly extinguiſht Light revive ſo faſt and perfectly, that it looked to us all almoſt like a little Flaſh of Lightning, and the Splendour of the Wood ſeemed rather greater than at all leſs, than before it was put into the Receiver.

But partly for greater certainty, and partly to enjoy ſo delightful a Spectacle, we repeated the Experiment with the like ſucceſs as at firſt. Wherefore being deſirous to ſee how ſoon theſe Changes might be produced, we included the Wood into a very ſmall Receiver of clear Glaſs, and found, That in this the Light would begin to grow faint at the ſecond, or at leaſt at the 3d Enſuction of the Air, and at the *6th* or *7th* would quite diſappear. And we found by a Minute-watch, that the ſending the Candles out of the Room, the pumping out the Air till the Wood would ſhine no more, the Re-admitting of the Air (upon which it would in a trice recover its Light) and the ſending in for the Candles to conſult the Watch, did in all take up but 6 Minutes.

Exp. III. Having exhauſted this new Receiver till the Wood quite diſappeared, we ſtayed ſomewhat above a quarter of an hour in the dark, without perceiving that the Wood had regained any thing of Light, tho' about the End of this time, we made the place about it as dark as we could; and then it being too late at Night to protract the Experiment, we let in the Air; upon whoſe Admiſſion, the Wood preſently recovered Light enough to be conſpicuous at a Diſtance, though it ſeemed to be ſomewhat leſs vivid than before; which yet may be either a Weakneſs in my Sight, or an Effect of the Steams of the Cements, unfriendly perhaps to the Luminouſneſs of the Wood.

The Night following, we put in a piece of Wood bigger than the former, this being above an Inch long, and that ſhone very vigorouſly; and having by a few ſucks quite deprived it of Light, we left it in the exhauſted Receiver for full half an hour, and then coming into the dark Room again, we found all had not continued ſo ſtanch, but that ſome ſmall Portion of Air had inſinuated itſelf into the Receiver. This we concluded to be but a ſmall Portion of Air, becauſe the Wood was but viſible to an attentive Eye. And yet that it was really ſome Air which was got in, that cauſed the little glimmering Light which we perceived may appear by this, that it did preſently (as we expected) vaniſh at the firſt or ſecond Suck; and then the Air being let into the dark Receiver, the included Wood preſently ſhone again as before; tho' I ſuſpected that I diſcerned ſome little Diminution of its brightneſs; which yet till further Trials of the like kind, and for a longer time have been made, I dare not affirm.

Exp. IV. Having obſerved on another Occaſion, That ſometimes the Operation, which the withdrawing the Air hath upon a Body included in the *Receiver*, proves more conſiderable ſome *Minutes* after we have ceaſed *Pumping*, than immediately after the Exerciſe is left off, I imagined, that even in ſuch Caſes, where the *Light* is not made wholly to diſappear (tho' it be made almoſt quite to do ſo) by the emptying of the *Pneumatical-glaſs*, the ſuffering the Body to remain a while there, though without any *Pumping* (unleſs now and then a very little to remove the *Air*, that might have ſtolen in in the mean time) the remaining light of the Body might probably be further impaired, if not reduced quite to vaniſh. To examine this Conjecture, we put in a Body that was not *Wood*, which had ſome parts much more *Luminous* than the reſt; and having drawn out the Air, all the others diſappeared, and even the formerly brighter ones ſhone but faintly, when the *Pneumatical-Glaſs* ſeem'd to be exhauſted. But keeping the included Body a while in that unfriendly place, we perceived the parts that had retained Light, to grow more and more dim, ſome of them diſappearing, and that which was formerly the moſt conſpicuous, being now but juſt viſible to an attentive Eye, and that ſcarce without diſpute, for if we had not known beforehand, that a ſhining matter had been included in the *Receiver*, perhaps we ſhould not have found it out. (And he that had the youngeſt Eyes in the Company could not at all diſcern it;) But the Air being let in, the Body began to ſhine again.

Exp. V. The *Rarefaction* or *Expanſion* of the *Air*, having ſo notable an operation upon our ſhining Wood, I thought it would not be amiſs to try what the *Compreſſion* of the *Air* would do to it: For which purpoſe we included a piece of it in ſuch a little Inſtrument to *compreſs* as hath been deviſed and propoſed by Mr. *Hook*. But tho' we impell'd the Air forcibly enough into the Glaſs, yet by reaſon of the Thickneſs requiſite in ſuch Glaſſes, and the Opacity thence ariſing, we were not able then to determine, whether or no any Change was made in the *Luminouſneſs* of the *Wood*. Which I thought the leſs ſtrange, becauſe by ſome *Experiments* purpoſely deviſed I had long ſince obſerved, That even a great Preſſure from a fluid Body, which preſſeth more uniformly againſt all the parts it toucheth of the conſiſtent Body, does work a far leſs manifeſt Change even on ſoft or tender Subſtances, than one would expect from the Force wherewith it compreſſeth.

Exp. VI. Thinking fit to try whether a ſmall Quantity of Air, without being ventilated or renewed, might not ſuffice to maintain this cold Fire, tho' it will not that of a live Coal, or a piece of Match, we cauſed a piece of ſhining Wood to be hermetically ſealed up in a Pipe of clear and thin Glaſs, but tho' carrying it into the dark, we found it had quite loſt its Light, yet imagining that that might proceed from its having been over-heated (being ſealed up in a Pipe not long enough to afford it a due Diſtance from the Flame of the Lamp we employ'd to ſeal it) we cauſed 2 or 3 pieces of freſh *Wood*, amounting all of them to the Length of about 2 Inches, to be ſeal'd up in a ſlender Pipe between 4 or 5 Inches in length; which being warily done, the Wood retained its Light very well, when the Operation was over; and afterwards laying it by my Bed-ſide, when the Candles were carry'd away out of the room, I conſidered it a while before I went to Sleep, and found it to ſhine vividly.

The next Morning when I awaked, tho' the Sun was riſen, yet forbearing to draw open the Curtains of my Bed 'till I had looked upon the ſeal'd Glaſs, which I had fenced with a piece of Cloth held between it and the Window, my Eyes having not yet been expoſed to the Day-light, ſince the Darkneſs they had been accuſtomed to during the Night, made me think the

Wood ſhined brighter than ever. And at Night, after 10 of the Clock, looking on it in a Dark place, it appeared *Luminous* all its length, though not ſo much as in the Morning.

The Morning after, and the Night, after that, the ſame Wood did likewiſe manifeſtly, though not vigorouſly Shine, eſpecially one piece, whoſe Light was much more Vivid than the reſt; And for ought I know, I might have obſerved them to ſhine longer, if one of the Sealed Ends of the Glaſs had not been accidentally broken.

Exp. VII. I cauſed a piece of Iron to be Forged, whoſe top was of the bigneſs of a Nutmeg; the reſt being a Stem, of an Inch, or an Inch and a half long, for which we provided a little Candleſtick of Tabaco-Pipe Clay, which would not yield any Smoak to fill and darken the *Receiver*. Then having heated the Iron Red-hot, and placed it in this Clay, ſo that the round part was clearly protuberant, we conveyed it into a *Receiver* of White Glaſs, which was ſo placed, as to keep the ſides at as great a diſtance as we could from the Iron, leaſt the exceſſive Heat ſhould (as we much feared it would) break the Glaſs. Then ſending away the Candles, and making the Room dark, we haſtily pumped out the Air, but could not perceive the withdrawing of it had any Operation on the Glowing Iron. And though it continued Shining long enough to give us an opportunity to Pump out and let in the Air three ſeveral times, yet we could not obſerve, that the Air had any manifeſt Operation one way or other. For though upon the withdrawing of the Air the Iron grew Dimmer and Dimmer, yet that I attributed to the Cooling of it; and the rather becauſe having (to examine the Conjecture) let in two or three times the Air, when the *Receiver* had been Exhauſted, there appeared no manifeſt Increaſe of Light upon the ſudden admiſſion of it.

Exp. VIII. Some Curious Perſons would perhaps, if they had been preſent, have deſired to ſee a Tryal made, whether or no a ſmall piece of *Shining Wood*, being ſo included in the *Receiver* as that the Pumping out of the *Air* ſhould have no Injurious Operation upon the Body of it, its Light would, upon the withdrawing of the *Air*, be manifeſtly diminiſhed; This way I was the leſs backward to try, becauſe it did not readily occur to my Memory, that by any manifeſt Experiment it appeared, that a Body more thin than *Air* will or can tranſmit Light, as well as other Diaphanous Mediums. Wherefore having *Hermetically Sealed* up a piece of Shining Wood in a ſlender Pipe, and placed it in a ſmall *Receiver* that was likewiſe made of clear Glaſs, we Exhauſted it of *Air*, and afterwards let in again that which we had excluded. But by neither of the Operations could we perceive any ſenſible Decrement or Increaſe of the Light of the Wood, though by that very Obſervation it appeared, that the Glaſs had been well Sealed, ſince otherwiſe the included *Air* would have got out of the Pipe into the *Receiver*, and have left the Wood without Light.

Exp. IX. I took an old but thin Glaſs, Sealed at one end, whoſe ſhape was pretty Cylindrical, and whoſe Bore was about the bigneſs of a Man's little Finger, and whoſe length was about a Foot or more. Into this Pipe, near the Sealed end, we put a piece of *Shining Wood*, wedged in with a piece of Cork to keep it from falling; and having inverted the Noſe of it into another Slender Glaſs; but not Cylindrical, wherein was pretty ſtore of Quick-ſilver; we put them both into a long *Receiver*, ſhaped almoſt like a Glaſs Churn, and having Pumped a while, that the *Air* included in the Pipe expanding it ſelf, might depreſs the Quick-ſilver, and ſo make eſcapes into the *Receiver* as long as we thought fit; we then let in the outward Air, that the *Stagnant* Quick-ſilver might be impelled into the Cavity of the Pipe now freed from much of the Air, to the height requiſite for our purpoſe.

This done, we plied the Pump again, and obſerved, that as the Air in the Pipe did by its own Spring expand it ſelf more and more, and grow Thinner and Thinner, the *Shining Wood* grew dimmer and dimmer, till at length it ceaſed to ſhine, the Internal Air being then got a good way lower than the Surface of the external Quick-ſilver; whereupon opening the Commerce between the Cavity of the *Receiver*, and the *Atmoſphere*, the Quick-ſilver was driven up again, and conſequently the Air above it was reſtored to its former Denſity; upon which the Rotten Wood alſo recovered its Light. What the greateſt Expanſion of this Air was, we could not certainly determine, becauſe the Expanſion raiſed the external Quick-ſilver ſo high, as to hinder us to ſee and meaſure it: But we gueſſed, that the Air reached to about a foot or more from the top of the Pipe to the Surface of the Quick-ſilver near the bottom of it. But when that rarified Air was impell'd into its former Dimenſions, we meaſured it, and found, that the upper part of the Tube, unpoſſeſt by the Quick-ſilver, was about 3 Inches; and the Wood being about an Inch long, there remained two Inches or ſomewhat better for the Air. But this Experiment ought to be repeated, when exacter Inſtruments can be procured.

Exp. X. Thinking it fit to try, as well, whether ſtinking Fiſh that ſhines be of the ſame Nature, as to *Luminouſneſs*, with Rotten Wood that ſhines too; as, whether the withdrawing of the Air will Extinguiſh or Eclipſe the Light of a conſiderable Bulk of *Luminous Matter*, as in the Experiments hitherto made, we found it would do to a ſmall one: We took a Fiſh tha we had kept, and cauſed to be watched till it was almoſt all over *Luminous* though much more in the Belly, and ſome parts of the Head than elſewhere And having ſuſpended him in a conveniently ſhaped *Receiver*, we found hi to give ſo great a Light, that we ſuſpected before hand that the withdrawing of the Air, would hardly have its full Operation upon a Body, who bulk was conſiderable as well as its Light very Vivid, and which had ma *Luminous* parts retired to a pretty diſtance from the Air. Accordingly having Exhauſted the *Receiver* as much as we were wont, it appeared indee eſpecially towards the latter end of the Operation, that the abſence of t Air did conſiderably leſſen, and in ſome places Eclipſe the Light of tho parts that ſhone leſs ſtrongly: But the Belly appeared not much leſs *Lum* *nous* than before. Wherefore ſuppoſing, that upon the turning of the *S* *cock*, the Air coming in much more haſtily than it could be drawn out, w ſhould have the beſt advantage to diſcern, what Intereſt it had in the *L* *minouſneſs* of the Fiſh, we re-admitted it: And upon its ruſhing in, preceiv the Light to be as it were revived and encreaſed; thoſe parts of the Fi

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that were ſcarce viſible before, or ſhone but dimly, receiving preſently their former Splendour.

And not to leave unproſecuted the remaining part of the Experiment, which was to try, whether it was the kind of the *luminous Body* or only the Greatneſs of the *Bulk*, and the *Vividneſs* of *Light*, and, if I may ſo ſpeak, the Tenacity of the Subſtance it reſided in, that made the Difference between the *Fiſh* and *Wood*; we put part of a Fiſh of another Kind, that ſhone much more faintly than that hitherto ſpoken of, and but in ſome places; and by the withdrawing the Air, we made ſome of the luminous parts diſappear, and the others ſo dim, as ſcarce to be diſcerned, and yet both the one and the other regained their former Light upon the return of the Air.

And to purſue the Experiment a little further, we put in ſuch a piece of the firſt Fiſh, as though it were bright, was yet but thin, and not conſiderably great, and upon pumping out the Air, we found it, according to our Expectation, quite eclipſed, though it recovered its Light upon the Air's Re-entry.

'Tis probable that ſome will make uſe of this Diſcourſe to countenance their Opinion, That notwithſtanding the Coldneſs (at leaſt as to Senſe) of Fiſhes and other Animals, there may be in the Heart and Blood a vital kind of Fire which needs Air, as well as thoſe Fires which are ſenſibly hot: Which may leſſen the Wonder, that Animals ſhould not be able to live when robb'd of Air.

Exp. XI. To examine the Conjecture mentioned in the laſt Experiment, That the durableneſs of the Light in the ſhining Fiſh, in ſpight of the withdrawing the Air, might proceed in great part from the *Vividneſs* of it, and the Beauty of the Matter it reſided in, rather than from the extent of the luminous Body, in Compariſon of the ſmall pieces of ſhining Wood, I hitherto had made my Tryals with; In *Dec.* 1667, I got a large piece of Wood, whoſe luminous Superficies might be perhaps 10 or 12 times as great as that which the Eye ſaw at once of the Surface of ſuch Fragments of ſhining Wood as I was wont to employ: And though ſome parts of this large Superficies ſhined vividly enough (for rotten Wood; for the Light was uſually inferior to that of our Fiſh) yet this great piece being put into a convenient Receiver, was, upon the withdrawing of the Air, deprived of light, as the ſmaller ones had been formerly; the returning Air reſtoring its Light to the one, as it had done to the other.

Exp. XII. I took ſome ſmall pieces of rotten Fiſh, that ſhone ſome of them more faintly, and ſome of them more vividly, in reference to one another, but none as ſtrongly as ſome that I could have employed; and having in a very ſmall and clear Receiver ſo far drawn off the Air, as to make the included Body diſappear, we ſo ordered the Matter, that we kept out the Air for about 24 Hours; and then allowing the Air to re-enter, in a dark Place, and late at Night, upon its firſt Admittance the Fiſh regained its Light.

Exp. XIII. This compared with ſome of my former Obſervations about Putrefaction, puts me upon a Trial, which, tho' it miſcarried, I ſhall here make mention of, that in caſe you, who are better furniſhed with Glaſſes, think it worth while, you may get reiterated by the Society's Operator; conſidering how great an Intereſt *Putrefaction* hath in the *ſhining* of *Fiſhes*, and *Air* in the *Phænomena* of *Putrefaction*, I thought it might be ſomewhat to the purpoſe, to take a *Fiſh*, that was, according to the common courſe I had obſerved in Animals, not far from the State, at which it would begin to *ſhine*; and having cut out a piece of it, I cauſed the reſt to be hung up again in a Cellar, and the exſected piece to be put into a ſmall and tranſparent Receiver, that we might obſerve, if a Day or two, or more, after the Fiſh in the Cellar ſhould begin to ſhine, that in the exhauſted Receiver would either alſo ſhine or (becauſe that ſeem'd not likely) would, notwithſtanding the Check which the Abſence of the Air might be preſumed to give the *Putrefaction*, be found to ſhine too, either immediately upon the Admiſſion of the Air, or not long after it.

But this *Experiment*, was only deſigned and attempted, not compleated; the *Receiver* being ſo thin, that upon the *Exhauſtion* of the internal Air, the Weight of the external broke it, and we could ill ſpare another of that kind from Trials, we were more concerned to make: Notwithſtanding which we made one Trial more, which ſucceeded no better than the former, but miſcarried upon a quite differing Account, *viz.* Becauſe neither the included piece of Fiſh, nor the remaining, tho' it were of the ſame ſort with the *Fiſhes* I uſually employed, would ſhine at all, tho' kept a pretty while beyond the uſual time, at which ſuch Fiſhes were wont to grow luminous. But that this Paragraph may not be uſeleſs to you, I'll take this Occaſion to giv you a couple of Advertiſements, that may relate not only to this Experiment, but alſo more generally to thoſe whether precedent or ſubſequent where *Shining Fiſh* are employ'd.

Advertiſement I. In the firſt place then, I will not undertake, that all th Experiments you ſhall make with rotten Fiſh, ſhall have juſt the ſame Su ceſs with theſe I have related. For, as I elſewhere obſerved, that the E vent of divers other Experiments is not always certain, ſo I have had Occ ſion to obſerve the like about *Shining* of *Fiſhes*. And I remember, that h ving once deſigned to make Obſervations about the Light of rotten Fiſh and having in order thereunto cauſed a competent Number of them to bought; not one of them all would ſhine; tho' they were bought by t ſame Perſon I was wont to employ, and hung up in the ſame Place whe uſe to have them put, and kept not only till they began to putrify, b beyond the time that others uſed to continue to ſhine: altho' a Parcel the ſame kind of Fiſhes, bought the Week before, and another of the ſa kind, bought not many days after, *ſhined* according to Expectation. Wh the reaſon of this Diſappointment was, I could not determine, only I member, that at the time it happen'd, the Weather was variable, and without ſome Days of Froſt and Snow.

Adver. II. Notice muſt alſo be taken in making Experiments with *ſhi* *Fiſh*, that their *Luminouſneſs* is not wont to continue very many days. Wh Advertiſement may be therefore uſeful, becauſe without it we may be

ſo

ſometimes to make Trials, that cannot be ſoon enough brought to an Iſſue, and ſo we may miſtake the Loſs of Light in the Fiſh to be a Deprivation of it, cauſed by the *Experiment*, which indeed is but a Ceſſation according to the uſual Courſe of Nature.

Exp. XIV. We put a piece of *Shining Fiſh* into a wide mouth'd Glaſs, about half filled with fair Water, and having placed this Glaſs in a *Receiver*, we exhauſted the Air for a good while, to obſerve, whether when the *Preſſure* of the Air was removed, and yet (by reaſon of the Water that did before keep the Air from immediately touching the Fiſh) the Exhauſtion of the Receiver did not deprive the Fiſh of that Contact of Air, which it had loſt before: Whether, I ſay, in this Caſe the Abſence of the Air would have the ſame Influence on the ſhining Body, as in the former Experiments.

And here, as far as the numerous Bubbles excited in the water would give us leave to diſcern it, we could not perceive, that either the abſence or return of the Air had any great Operation upon the Light of the immerſed Body.

I ſhall here inform you, that tho' when I formerly put together ſome Notes about luminous Bodies, I confined not my Obſervations to one or two Sorts of Fiſhes, yet theſe Experiments were all of them (except a collateral one or two) made with *Whitings*, which among the Fiſhes, I have had Occaſion to take Notice of, is (except one ſort that I cannot procure) the fitteſt for ſuch Trials.

Exp. XV. To proſecute the I. and IX. Experiments in one Trial, we took ſomewhat late at Night a Piece of rotten Fiſh, which we judged to ſhine too ſtrongly to be quickly deprived of all its Light, and having put it into a ſmall and clear *Receiver*, we found, as we had foreſeen, that the *Light* was much impaired, but nothing near ſuppreſſed by the withdrawing of the Air. Wherefore having removed the *Receiver* into a convenient place, I caus'd it to be brought to me about Midnight, and having made the place pretty dark, I perceived the included Body to continue to ſhine more vividly than one would have expected, (and if I miſtake not I ſaw it ſhining in the Morning whilſt it was dark;) but the Night after, coming to look upon it again, its *Light* appeared no more: Notwithſtanding which, I made a ſhift to keep out the Air about 24 Hours longer, and ſo after 48 Hours in all, we opened the *Receiver* in a dark Place, and preſently upon the *Ingreſs* of the Air, were pleaſingly ſaluted with ſo vivid an Apparition of Light, that the included Body continued to ſhine, when carried into a Room, where there was both Fire and Candle, if it were but by a *Hat* skreen'd from the Beams.

Being encouraged, as well as pleaſed with this Succeſs, we forthwith exhauſted the Air once more out of the ſame *Receiver*, and having kept it about 4 Hours longer, we look'd upon it again in a dark Place, and finding no Appearance of Light, let the Air in upon it, whereby it was made to ſhine again, and that vigorouſly enough.

The Suddenneſs, with which the included Body appear'd to be, as 'twere *rekindled* upon the firſt Contact of the *Air*, revived in me ſome Suſpicions, I have had about the poſſible Cauſes of theſe *ſhort liv'd Apparitions of Light*, (for I ſpeak not now of real Lamps found in Tombs, for a Reaſon to be told you another time) which diſcloſing themſelves upon Mens coming in, and conſequently letting in freſh *Air* into Vaults, that had been very long cloſe, did ſoon after vaniſh.

Theſe thoughts, as I was ſaying, occurred to me upon what I had been relating, by reaſon of the *ſudden Operation* of the freſh Air upon a Body, that but a Minute before diſcloſed no *Light*. For tho' the *Lights* reported to have been ſeen in Caves, quickly diſappeared, which that of our Fiſh did not; yet that difference might poſſibly proceed from the Tenacity, or ſome other diſpoſition of the matter, wherein the *Luminouſneſs* of the Fiſh reſides: For I remembred that I had more than once obſerved a certain glimmering and ſmall *Light* to be produced in a ſort of bodies, upon putting them out of their former reſt, and taking them into the air; which ſparks would vaniſh themſelves, ſometimes within one *Minute*, ſometimes within a few *Minutes*. But as theſe Thoughts were but tranſient Conjectures: ſo I ſhall not entertain you any longer about them, but rather contenting my ſelf with the Hint already given, take notice of what may be more certainly deduced from our *Experiment*, which is, That the *Air* may have a much greater Intereſt in divers odd *Phænomena* of Nature, than we are hitherto aware of.

And for Confirmation of our *Experiment*, I ſhall add, that having in another *Receiver* eclipſed a piece of Fiſh that ſhone when 'twas put in more *languidly* than divers others that we had tried, I kept it about 3 Days and 3 Nights in a *Receiver*; after which I opened it in the dark, and upon letting in the Air upon this Body, that ſhined but faintly at firſt, it immediately recovered its ſo long ſuppreſſed *Light*. And having included another Piece that was yet more faint than this, when it was put into the *Receiver*, and having kept this Piece alſo 3 days and 3 Nights in the exhauſted Glaſs, I let in the Air upon it, and notwithſtanding the Darkneſs of the Place, nothing of *Life* was thereupon revived. But this being little other than I expected from a Body that ſhined ſo faintly, when 'twas put into the *Receiver*, and had been kept there ſo long, I reſolved to try whether the Appulſe and Contact of the air would have that operation after ſome Time that it had not at firſt; and accordingly, after having waited a while, I obſerved the Fiſh to diſcloſe a *Light*, which tho' but dim, was yet manifeſt enough.

I ſhall only add, That having included in ſmall *Receivers* 2 Pieces of rotten *Whitings*, whereof the one, before it was put in, ſcarce ſhone ſo vividly as did the other after the *Receiver* was exhauſted; and having ordered the Matter ſo, that we were able to keep out the Air for ſome days, at the end of about 48 *Hours*, we found, that the more *ſtrongly ſhining* Body retained yet a deal of *Light*; but afterwards looking upon them both in a dark place, we could not perceive in either any Show of *Light*. Wherefore having let in the air into that *Receiver*, whereinto the body that at firſt *ſhined* the faintlier had been put, there did not enſue any *Glimmering* of *Light* for a pretty while; nay, upon the ruſhing in of the air into the other glaſs, the Body that at firſt *ſhone* ſo *ſtrongly*, and that continued to *ſhine* ſo long, ſhewed no glimmering of Light. But within leſs than a quarter of an hour we ſaw a manifeſt light in the body laſt named, and a while after the other alſo became viſible, but by a Light very dim. The more *Luminous* of theſe Bodies I obſerved to retain ſome Light 24 Hours after; and the hitherto recited Experiment had this peculiar inſtance in it; That the 2 *Receivers* were uninterruptedly kept Exhauſted no leſs than 4 Days, and as many Nights.

Pneumatical *Experiments; By* Mr. Boyle, n. 62. p. 2011. *Upon Ducks.*

LXXVII. I. 1. We put a full grown Duck into a *Receiver*, whereof ſhe fill'd, by our Gueſs, a third part or ſomewhat more, but was not able to ſtand in any eaſie Poſture in it; then Pumping out the Air, within the ſhort ſpace of one Minute, ſhe appeared much diſcompoſed, and between that and the ſecond Minute, her Strugling and Convulſive Motions increaſed ſo much, that, her Head alſo hanging careleſly down, ſhe ſeemed to be juſt at the Point of Death: So that, it did not appear that, notwithſtanding the peculiar ſtructure of ſome Veſſels about the Heart, which enables theſe and other *Water Birds* to continue without Reſpiration for ſome time under the Water, this Duck was able to hold out conſiderably longer than a *Hen*, or other *Bird not Aquatick* might have done.

This *Duck*, being revived upon the admiſſion of Freſh *Air*, and again ſhut up in the ſame *Receiver* with the *Air* in it, continued five times as long as before, without appering any ways diſcompoſed.

2. We conveyed a *Duckling*, that was not yet Callow, into the ſame *Receiver*, and obſerv'd, that before the firſt Minute was quite ended, ſhe gave manifeſt tokens of being much diſordered, and being a Second Minute was expired, ſeveral *Convulſive Motions* obliged us to let the Air in upon her, whereby ſhe quickly recover'd.

N. B. When the *Receiver* was pretty well Exhauſted, ſhe appeared manifeſtly bigger, than before the Air was withdrawn, eſpecially about the Crop, though that was very Turgid before. We kept the ſame *Duckling* in the ſame *Receiver* very cloſe, to keep out all *External Air*, and to keep in the *Excrementitious* Steams of her Body for above 6. *Min.* without perceiving her to grow Sick upon her Impriſonment.

Vipers.

II. 1. *Jan.* 2. 166$\frac{2}{3}$. We included a Viper in a ſmall *Receiver*, and as we drew out the Air; ſhe began to Swell, and afforded us theſe *Phænomena.*

1. It was a good while after we had left Pumping, e're the Viper began to Swell ſo much as to be forced to Gape, which afterwards ſhe did.

2. That ſhe continued, by our Eſtimate, above 2½ Hours in the Exhauſted *Receiver*, without giving clear Proof of her being kill'd.

3. That after ſhe was once ſo Swelled, as to be compelled to open her Jaws, ſhe appeared ſlender and lank again, and yet very ſoon after appear'd Swell'd again, and had her Jaws disjoyned as before.

2 We took a Viper, and including her in the greateſt ſort of ſmall *Receivers*, we emptied the Glaſs very carefully, and the Viper mov'd up and down within, as it were to ſeek for Air, and after a while foamed a little at the Mouth, and left of that Foam ſticking to the inſide of the Glaſs. Her Body Swelled not conſiderably, and her Neck leſs, till a pretty while after we had left Pumping; but afterwards the Body and Neck grew prodigiouſly Tumid, and a Bliſter appeared upon the Back. An Hour and an half after the Exhauſtion of the *Receiver* (which we then by Trial found to

be pretty ſtaunch) the diſtended Viper did give by Motion manifeſt Signs of Life; but we obſerved none afterwards. The Tumor reached to the Neck, but did not ſeem much to Swell the under Chap. Both the Neck and a great part of the Throat, being held betwixt the Eye and the Candle, were tranſparent enough, where the Scales did not darken them. The Jaws remained mightily opened, and ſomewhat diſtorted; the *Epiglottis* with the *Rimula Laryngis* (which remained gaping) was protruded almoſt to the further end of the nether Chap. As it were from beneath this *Epiglottis* came the black Tongue, and reached beyond it, but ſeemed by its poſture not to have any Life, and the Mouth alſo was grown blackiſh within: But the Air being readmitted after 23 Hours in all, the Viper's Mouth was preſently clos'd, though ſoon after it was open'd again, and continued long ſo; and ſcorching or pinching the Tail made a Motion in the whole Body, that argued ſome Life.

3. *April*. 25. We included an Ordinary harmleſs Snake, together with a Gage, in a pretty portable *Receiver*, which, being Exhauſted and well ſecur d againſt the *Ingreſs* of the *Air*, was laid aſide in a quiet place, where it continued from 10. or 11. a Clock in the Forenoon, till about 9. the next Morning; and then, though he ſeem'd to be dead, and gave no Signs of Life upon the Shaking of the *Receiver*, yet upon holding the Glaſs at a convenient Diſtance from a moderate Fire, he did in a ſhort time manifeſt himſelf to be Alive by ſeveral tokens, and even by putting forth his Forked Tongue. In that Condition I left him, till the next Day early in the Afternoon; at which time he was grown paſt recovery, and his Jaws, which were formerly ſhut, gaped exceeding wide, as if they had been ſtretched open by ſome External force.

Froggs. III. 1. *Sept*. 9. 1662. We took a large luſty Frog, and having included her in a ſmall *Receiver*, we drew out the Air, and left her not very much Swell'd, and able to move her Throat from time to time, though not ſo faſt as when ſhe freely breathed before the Exſuction of the Air. She continued alive about 2 Hours that we took notice of, ſometimes removing from the one ſide of the *Receiver* to the other; but ſhe Swell'd more than before, and did not appear by any Motion of her Throat or Thorax to exerciſe Reſpiration, but her Head was not very much Swell'd, nor her Mouth forced open. After ſhe had remained there ſomewhat above 3 Hours (for it was not 3½ Hour) perceiving no Sign of Life in her, we let in the *Air* upon her, with which the formerly Tumid Body ſhrunk very much, but ſeem'd not to have any other Change wrought in it; and though we took her out of the *Receiver*, yet in the *Free Air* it ſelf, ſhe continued to appear ſtark Dead. Neverthe leſs to ſee the utmoſt of the Experiment, having cauſed her to be laid upon the Graſs in a Garden all Night, the next Morning we found her perfectly Alive again.

2. *Jun*. 29. 1660. About 11. of the Clock in the Forenoon, we put a *Frog* into a ſmall *Receiver*, containing about 15¼ *Ounce Troy* Weight of *Water*, out of which we had tolerably well drawn the *Air*, (ſo that when we turned the Cock under *Water*, it ſucked in about 13¼ *Ounces* of *Water*:) The *Frog* con-

tinued in it (the *Receiver* all the while under *Water) lively* enough till about 5 of the Clock in the Afternoon, when it expir'd. The *Frog* at the firſt ſeem'd not to be much altered by the *Exſuction* of the *Air*, but continued *Breathing* both with her Throat and Lungs.

3. *Sept.* 6. 1662. We included into a large *Receiver* a couple of *Frogs* newly taken, the one not above an Inch long, and proportionally ſlender; the other very large and luſty. Whilſt the *Air* was drawing out, the leſſer *Frog* skipped up and down very lively, and ſomewhat to our Wonder, clambered up ſeveral times to the ſides of the *Receiver*, inſomuch that he ſometimes reſted himſelf againſt the ſides of the Glaſs; when his Body ſeem'd to be perpendicular to the *Horizon*, if not in a *Reclining Poſture*. He continued to skip up and down a while after the *Exſuction* of the *Air*, but within a quarter of an Hour (meaſured by a *Minute-watch*) we perceived him to lie ſtark dead, with his Belly upwards. The other *Frog* that was very large and ſtrong, tho' he began to ſwell much upon the withdrawing of the *Air*, and ſeem'd to be diſtreſſed, by his frequently leaping up, after the *Air* was drawn out, which he did not before, yet being as we ſaid very luſty, he held out half an Hour; at which time the Weight of the outward *Air* broke the *Receiver*, and thereby brought him a Reprieve.

4. *Sept.* 11. We took a ſmall *Frog*, and having conveyed her into a very ſmall portable *Receiver*, we began to pump out the Air. At firſt ſhe was lively enough, but when the Air began to be conſiderably withdrawn, ſhe appeared to be very much diſquieted (leaping ſometimes after an odd manner, as it were to get out of the uneaſie Priſon) but yet not ſo but that after the Operation was ended, and the *Receiver* taken off, the *Frog* was perfectly alive, and continued to appear ſo (if I am not miſtaken) near an hour, tho' the *Abdomen* was very much, and the *Throat* ſomewhat extended; this latter part having alſo left that wonted panting Motion, that is ſuppoſed to argue and accompany the *Reſpiration* of *Frogs*. At the End of about 3¼*th* Hours, after the Removal of the *Receiver* from the *Pump*, the Air was let in; whereupon the *Abdomen*, which by that time was ſtrangely ſwell'd, did not only ſubſide, but ſeem'd to have a great Cavity in it, as the Throat alſo proportionally had; which Cavities continued, the *Frog* being gone paſt all Recovery.

5. *Apr.* 14. A large *Frog* was conveyed into a plated *Receiver*, and the *Air* being withdrawn, her Body by Degrees was diſtended. The *Receiver* with the *Gage* were kept under Water near 7 Hours; at the End of which I found the *Receiver* ſtaunch, but the *Frog* dead, and exceedingly ſwelled; upon the letting in of the Air, ſhe became more hollow and lank than ever.

1. Being deſirous to try, whether *Animals* that had lately been accuſtomed to live either without any, or without a full *Reſpiration*, would not be more difficultly or ſlowly kill'd by the want of the *Air*, than others, which had been longer uſed to a free *Reſpiration*, we took a *Kitling* that had been kitten'd the Day before, and put it into a very ſmall Receiver. that we gueſſed to hold about a Pint or leſs, that it might be the ſooner exhauſted. Within one *Minute*, or a little more, after the *Air* firſt began to be withdrawn, Kitlings.

drawn, the little Animal, who in the mean time had gaſped for Life, and had ſome violent *Convulſions*, lay as dead, with his Head downwards, and his Tongue out; but upon letting in of the Air, he did in a trice ſhew ſigns of Life, and being taken out of the *Receiver*, quickly recovered.

Another of the ſame Litter being put into the ſame *Receiver*, quickly began, like the other, to have *Convulſions*, after which he lay as dead. But tho' we continued pumping, and could not perceive that the *Engine* leaked more than in the former Experiments; the *Kitling* began to ſtir again, and after a while had ſtronger and more general *Convulſions* than before, till at the end of full 6 *Minutes* after the *Exſuction* of the *Air* was begun, the *Animal* ſeeming quite dead, was taken out of the Veſſel, and lay with its Mouth open, and his Tongue lolling out, without any ſenſible Breathing and Pulſation; till having ordered him to be pinched, the Pain, or ſome internal Motion, produced by the external Violence done to him, made him immediately give manifeſt Signs of Life, tho' there was yet no ſenſible motion of the *Heart* or the *Lungs*; but afterwards gaping and fetching his *Breath* in an odd Manner, and with much ſtraining, as I have ſeen ſome *Fœtus*'s do when cut out of the *Womb*, he by little and little, within about a Quarter of an Hour recovered.

Incloſing another *Kitling* kitten'd at the ſame time, in the ſame *Receiver*, we obſerv'd, that divers violent *Convulſions*, as it were gaſping for Breath, into which he began to fall at the ſecond or third Suck, ended in a ſeeming Death, within about a Minute and a half. A while after, notwithſtanding our continuing to pump, the *Kitling* gave manifeſt Signs of Life, which was not till it had endured divers Convulſions, as great as thoſe of the firſt Fit, if not greater. When 7 *Min.* from the Beginning of the Exhauſtion were compleated, we let in the *Air*, upon which, the little Creature that ſeem'd ſtark dead before, made us expect that he might recover; but tho' we took him out of the *Receiver*, and put *Aqua Vitæ* into his Mouth, yet he irrecoverably died in our Hands.

By what has been related, it appears, that thoſe Animals continued 3 times longer in the exhauſted Receiver, than other Animals of that Bigneſs would probably have done.

The Air conceal'd in the Pores of Liquors.

V. 1. We put ſome Water in an open *Tube*, and ſuffer'd the *Air Latitant* in it to eſcape in an *Exhauſted Receiver*, without any Artifice to catch it; by which Trial, the Water did not part with any thing of its Bulk, that made a Diminution ſenſible to the Eye.

2. A chymical Pipe, ſeal'd at one End, and 36 *Inches* (or ſomewhat leſs) in length, was fill'd with Water, and inverted into a glaſs Veſſel, not two *Inches* in Diameter, and but $\frac{1}{4}$*th* of an *Inch* or little more in Depth. Theſe Glaſſes being conveyed into a fit Receiver, and the *Air* being leiſurely pump'd out, and ſomewhat ſlowly re-admitted, the numerous Bubbles that had aſcended during the Operation, conſtituted at the Top an *Aerial Aggregate*, mounting to $\frac{8}{10}$ wanting about 100 part of an *Inch*.

3. Preſently after another Tube was fill'd again with the ſame Water, and inverted, and the Water being drawn down to the Surface of the veſſel

ſelled Water, and the Air let in again, the Water was impell'd up to the very Top. within a 10*th* and half a Tenth of an *Inch*.

4. The *Tube* for meaſuring the *Air* latitant in the Water, was 43½ *Inches* above the ſurface of the ſtagnant Water: The *Air* collected out of the Bubbles at the Top of the Water, was the firſt time ¾ of an *Inch*, and ſomewhat better; the ſecond time we eſtimated it but ⅜ and ⅛. The firſt time the water in the *Pipe* was made to ſubſide full as low as the ſurface of the reſtagnant Water: The ſecond time, the loweſt we made it ſubſide ſeem'd to be 4 or 5 *Inches* above the ſurface of the Water in the open Veſſel.

I muſt here advertiſe, that the *Air* at the top of the *Tube* did poſſeſs more Room than its Bulk did abſolutely require, becauſe is was ſomewhat defended from the Preſſure of the *Atmoſphere* by the weight of the ſubjacent *Cylinder* of *Water*, which might be about 3 or 4 Foot long.

5. We provided a clear round *Glaſs*, furniſh'd with a *Pipe* or *Stem* of about 9 *Inches* in length, the *globulous part* of the Glaſs being on the outſide about 3½ *Inches* in Diameter; the *Pipe* of this Glaſs was within an *Inch* of the Top melted at the Flame of a Lamp, and drawn out for two or three Inches as ſlender as a *Crow*'s Quill, that the Decrement of the *Water* upon the Receſs of the *Air* harboured in its *Pores*, might, if any ſhould happen, be the more eaſily obſerved and eſtimated. Above this ſlender part of the *Pipe*, the *Glaſs* was of the ſame largeneſs (or near it) with the reſt of the *Pipe*, that the *Aerial Bubbles*, aſcending thro' the ſlender part, might there find Room to break, and ſo prevent the over-flowing, or loſs of any part of the *Water*.

This Veſſel being not without Difficulty and ſome Induſtry fill'd, till the *Liquor* reached to the top of the ſlender part, where not being uniformly enough drawn out, it was ſomewhat broader than elſewhere; we conveyed the Glaſs, together with a Pedeſtal for it to reſt upon into a tall *Receiver* and pumping out the Air, there diſcloſed themſelves numerous *Bubbles* aſcending nimbly to the upper part of the *Glaſs*, where they made a kind of Froth or Foam; but by Reaſon of the above mentioned Figuration of the Veſſel, they broke at the Top of the ſlender part, and ſo never came to overflow. This done, the *Pump* was ſuffer'd to reſt a while, to give the *Aerial Particles*, lodged in the *Water*, time to ſeparate themſelves and emerge, which when they had done a pretty while, the *Pump* was ply'd again, for fear ſome *Air* ſhould have ſtolen into ſo large a *Receiver*.

Theſe Viciſſitudes of *Pumping* and *Reſting* laſted for a conſiderable Time, till at length the *Bubbles* began to be very rare, and we weary of waiting any longer; ſoon after which, the external Air was let into the *Receiver*, and it appear'd ſomewhat ſtrange to the Spectators, that notwithſtanding ſo great a Multitude of *Bubbles* as had eſcaped out of the *Water*, I could not by attentively comparing the Place where the ſurface of the *Water* reſted at firſt (to which a Mark had been affix'd) with that where it now ſtood, I could not, I ſay, diſcern the Difference to amount to above, if ſo much, as an Hair's breadth; and the chief Operator in the Experiment profeſſed, that for his part, he could not perceive any Difference at all.

6. Filling a Glaſs of the ſame *Shape*, and much of the ſame Bigneſs, with *Claret-wine*, and placing it upon a convenient Pedeſtal, in a tall *Receiver*, we cauſed ſome of the *Air* to be pumped out: whereupon in a ſhort time there emerg'd thro' the ſlender Pipe, ſo very great a Multitude of Bubbles, that were darted as it were upwards, as did not a little both pleaſe and ſurprize the Beholders: But it forced us to go warily to work, for Fear the Glaſs ſhould break, or the *Wine* overflow. Wherefore we ſeaſonably left off pumping, before the *Receiver* was any thing near exhauſted, and ſuffered the *Bubbles* to get away as they could, till the preſent Danger was over paſſed, and then from time to time we pumped a little more Air out of the *Receiver*, till we were weary, the withdrawing of a moderate Quantity of Air at a time ſufficing, even at the latter end, to make the *Bubbles* not only copiouſly, but very ſwiftly aſcend, (by a *Minute-watch)* for above a Quarter of ſame an Hour together.

Shell-Fiſhes. VI. 1. An *Oyſter* being put into a very ſmall *Receiver*, and kept in long enough to have ſucceſſively kill'd three or four Birds or Beaſts, *&c.* Was not thereby kill'd, nor, for ought we could perceive, conſiderably diſturb'd, only at each Suck we perceived, that the Air contain'd between the 2 *Shells* broke out at their Commiſſure; as we concluded from the Foam which at thoſe times came forth all round that Commiſſure. About 24 Hours after, I found that both this and another that had been put into the *Receiver* at the ſame time, were alive.

2. We put a pretty large *Craw-Fiſh* into a pretty large *Receiver*, and found that tho' he had been injur'd by a Fall before he was brought thither, yet he ſeem'd not to be much incommoded by being included, till the Air was in great Meaſure pumped out, and then its former Motion preſently ceas'd, and he lay as dead; till upon the letting in a little Air into the *Receiver*, he began forthwith to move afreſh; and upon the withdrawing the *Air* again, oe preſently, as before, became moveleſs. Having repeated this Trial 2 or 3 Times, we took him out of the Receiver, where he appear'd not to have ſuffer'd any Harm.

3. Having put an *Oyſter* into a Vial full of *Water*, before we included it in the *Receiver*, it prov'd ſo ſtrong as to keep it ſelf cloſe ſhut, and repreſs'd the *Eruption* of the *Bubbles* that in the other did force open the Shells from Time to Time, and kept in its own Air as long as we had Occaſion to continue the Trials.

4. Moreover a *Craw-Fiſh*, that was thought more vigorous, being ſubſtituted in the Place of the former *Craw-Fiſh*, tho' once he ſeemed to loſe his *Motion* together with the Air, yet afterwards he continued moving in the Receiver, in ſpight of our pumping.

A Seal Fiſh. VII. We took a *Receiver* ſhap'd almoſt like a *Bolt-head*, containing by Eſtimation near a *Pint*, and the *globulous* part of it being almoſt half full of *Water*, we put into it, at the *Orifice* (which was pretty large) a ſmall *Gudgeon*, about 3 *Inches* long, which when it was in the *Water*, ſwam nimbly up and down therein. Then having drawn out the *Air* ſo well, that we gueſſed by a *Gage*, that about 19 parts of 20 or more might be Exhauſted, we ſecured our ſelves that the Regreſs of the *Air* ſhould not injure our Experiment, about which we obſerv'd that,

1. The Neck of the Glaſs being very long, though there appear'd great ſtore of Bubbles all about the Fiſh; yet the reſt of the Water, notwithſtanding the withdrawing of ſo much *Air* as had been mention'd emitted no Froth, and but few Bubbles.

2. The Fiſh both at his Mouth and Gills did, for a great while, diſcharge ſuch a Quantity of Bubbles as appear'd ſtrange and for about half an Hour or more (for much longer I had not Opportunity to watch it;) whenever he reſted a while, new Bubbles would adhere to many Parts of his Body (as if they were generated there) eſpecially his Fins and Tail: So that he would appear almoſt beſet with *Bubbles*; and if, being excited to Swim, he was made to ſhake them off, he would quickly, upon a little Reſt, be beſet with new ones as before.

3. Almoſt all the while, he would gape and move his Gills, as before he was included; though towards the end of the time that I watch'd it often happened, that he neither took in, nor Emitted any *Aerial* Particles that I could perceive.

4. After a while, he lay almoſt conſtantly with his Belly upwards, and yet would in that Poſture Swim briskly as before.

5. Nay, after a while, he ſeem'd to be more Lively than at firſt putting in; whether by Reaſon, that by Diſcharge of ſo many Bubbles, which by their Diſſenſion, perhaps, put him to Pain, he found himſelf relieved, or for ſome other Cauſe, I examine not.

6. About an Hour and an Half after he had been Seal'd up, I found him almoſt free from Bubbles, and with his Belly upwards, and ſeeming ſomewhat Tumid, but yet lively as before. But an Hour and a Quarter after that, he ſeem'd to be moveleſs and ſomewhat ſtill; yet upon ſhaking the Glaſs, obſerving ſome faint Signs of Life in him by ſome Languid Motions, he attempted to make when excited to them, I opened the *Receiver* under *Water*, to try if that Liquor and Air would recover him; and the External *Water* ruſhing in, till it had fill'd the vacant part of the Ball, and the greateſt part of the Stem too, the Fiſh Sunk at the bottom of it, with a greater appearance than ever of being alive; in which State after he had continued a pretty while, I made a ſhift, by the help of the *Water* he ſwam in, to get him through the Pipe into a Baſon of *Water*, where he gave more manifeſt Signs of Life: But yet for ſome *Hours* lay on one ſide or other, without being able to ſwim or lie on his *Belly*, which appeared very much ſhrunk in, as if ſomething, during the time of its being *Seal'd* up, had been broken in his *Body*, or his *Belly* had been exceedingly diſtended, beyond Reſtitution of its former Tone.

All the while he continued in the Baſon of *Water*, though he moved his Gills as before he had been Seal'd up; yet I could not perceive, that he did, even in his new *Water*, Emit, as formerly, any *Bubbles*, though two or three times I held him by the Tail in the *Air*, and put him into the *Water* again, where at length he grew able to lie conſtantly upon his Belly, which yet retained much of its former Lankneſs. He lived in the Baſon, 8 or 10 Days, though divers other *Gudgeons* dy'd there in much fewer Days.

Wounded Animals.

VIII. 1. *Sept.* 12. A ſmall *Bird*, having the *Abdomen* open'd almoſt from Flack to Flank, without injuring the *Guts*, was put into a ſmall *Receiver*, and the *Pump* being ſet a-work, continued for ſome time without giving any Signs of Diſtreſs: But at the end of about *Minute* and a *half* from the begining of the *Exhauſtion*, ſhe began to have *Convulſive* Motions in the Wings; and though the *Convulſions* were not Univerſal, or did appear Violent, as is uſual in other *Birds* from whom the Air is withdrawn by the Engine, yet at the end of two full *Minutes*, letting in the Air, and then taking off the *Receiver*, we found the *Bird* irrecoverable; notwithſtanding which we did not find any notable Alteration in the *Lungs*, and found the *Heart* (or at leaſt the *Auricles* of it) to be yet beating, and ſo it continued for a while after.

2. We took alſo a pretty large *Frog*, and having, without violating the *Lungs* or the *Guts*, made two ſuch Inciſions in the *Abdomen*, that the two curl'd *Bladders* or *Lobes* of *Lungs* came out almoſt totally at them, we ſuſpended the *Frog* by the Legs in a ſmall *Receiver*, and after we had pump'd out a good part of the Air, the Animal Strugled very much, and ſeem'd to be much diſorder'd, and when the *Receiver* was well Exhauſted, ſhe lay ſtill for a while as if ſhe had been Dead, the *Abdomen* and Thigh very muſt ſwell'd, as if ſome *Rarified Air* or Vapour forcibly diſtended them. But as, when the *Frog* was put in, one of the *Lobes* was almoſt Full, and the other almoſt ſhrunk up, ſo they continued to appear, after the *Receiver* had been Exhauſted; but upon letting in of the Air, not only the Body ceaſed to be Tumid, but the Plump Bladder appear'd for a while ſhrunk up as the other, and the *Receiver* being remov'd, the *Frog* preſently *Reviv'd*, and quickly began to fill the *Lobe* again with Air.

The ſeparated Hearts of Cold Animals

IX. 1. The *Heart* of an *Eel* being taken out and laid upon a Plate of Tin in a ſmall *Receiver* when we perceived it to Beat there as it had done in the open *Air*, we Exhauſted the Veſſel, and ſaw, that though the *Heart* grew very Tumid, and here and there ſent forth little Bubbles, yet it continued to beat as manifeſtly as before and ſeem'd to do ſo more ſwiftly; as we tryed by numbering the *Pulſations* it made in a *Minute*, whilſt it was in the Exhauſted *Receiver*, and when we had readmitted the *Air*, and alſo when we took it out of the Glaſs and ſuffered it to continue its Motion in the open *Air*.

2. The *Heart* of another *Eel*, after having been included in a *Receiver*, firſt *Exhauſted* and then accurately ſecur'd from leaking, though it appear'd very Tumid, continued to *Beat* there an Hour; after which looking upon it, and finding its Motion very Languid, and almoſt ceas'd, by breathing a little upon that part of the Glaſs where the Heart was, it quickly regained Motion, which I obſerv'd a while, and an *Hour* after finding it to ſeem almoſt quite gone, I was able to renew it by the Application of a little more Warmth.

At the End of the 3*d Hour* I could no more excite it by *Warmth*: Wherefore I ſuffer'd the outward *Air* to ruſh in, but could not diſcern, that thereby the *Heart* regained any ſenſible Motion, though aſſiſted with the *Warmt* of my *Breath* and *Hands*.

X. A ſufficient Number of Inſtances of *Animals* kill'd in the Exhauſted *Receiver*, is to be met with in our other Experiments: And therefore I ſhall now ſubjoyn ſome Trials, about the Times wherein Animals may be kill'd by that want of Reſpiration, which, in thoſe that are Drowned, is cauſed by the *Water* that Suffocates them.

Animals Drowned *and Depriv'd of Air.*

1. *Sept.* 10. A *Green Finch*, having his Legs and Wings tyed to a weight, was gently let down into a *Glaſs body* fill'd with *Water*; and at the end of *half* a *Minute* he was found quite *Dead*.

2. A *Sparrow*, that was luſty and quarrelſome, was let down after the ſame manner; but though he ſeem'd to be under *Water* more vigorous than the other Bird, and continued ſtrugling almoſt to the very end of *Half* a *Minute* from the time of his being totally *Immerſed* (during which ſtay under *Water* there Aſcended from time to time, pretty large *Bubbles* from his Mouth) yet notwithſtanding that as ſoon as ever the *half* a *Minute* was compleated he was drawn up, we found him, to our Wonder, *irrecoverably gone*.

3. A ſmall *Mouſe*, being held under *Water* by the Tail, Emitted from time to time divers *Aerial Bubbles* out of his Mouth, and at laſt, as one of the Spectators affirmed he ſaw, at one of his Eyes; being taken out at the end of half a Minute and ſome few Seconds, he yet retained ſome Motions: But they proved but Convulſive ones, which at laſt ended in *Death*.

4. We took the *Duck* (mentioned above) and ſo tyed a conſiderable Weight of Lead to her Body, as it did not hinder her Reſpiration; and yet would be ſure to keep her down under *Water*. With this Clog ſhe was put into a Tub full of clear *Water*, under whoſe Surface ſhe continued about a Minute by my Watch quietly enough, but afterwards began to appear for a while much diſturbed; which fit being over, our not perceiving any Motion in her made us, at the end of the *Second Minute*, take her out of the *Water*, to ſee in what Condition ſhe was, and finding her in a good one, after we had allow'd her ſome Breathing time to recruit her ſelf with *Freſh* Air, we let her down again into the Tub, which in the mean time had been fill'd with *Freſh Water*. After a while, ſhe begun, and from time to time continued, to Emit divers *Bubbles* at her Beak. There alſo came out at her Noſtrils divers real *Bubbles* from time to time; and when the Animal had continued about *two Minutes* or better under *Water*, ſhe began to ſtruggle very much, and to endeavour either to Emerge, or change Poſtures; the latter of which ſhe had liberty to do, but not the former. After *Four Minutes* the *Bubbles* came much more ſparingly from her: Then alſo ſhe began to Gape from time to time, (which we had not obſerv'd her to do before,) but without Emitting *Bubbles*; and ſo ſhe continued gaping till near the end of the *6th Minute*, at which time all her Motions, ſome of which were judg'd *Convulſive*, and others that had been excited by our rouzing her with a Forceps, appear'd to ceaſe, and her Head to hang careleſly down as if ſhe were quite Dead. Notwithſtanding which, we thought fit for greater ſecurity to continue her under *Water* a full *Minute* longer, and then finding no Signs of Life we took her out; and being hung by the Heels, and gently preſs'd in convenient Places, ſhe was made to void a pretty

Vid. Sup. 3[illegible] *Exp.* 1.

Quantity of *Water*. But all the Means that were uſed, to recover the *Bird* to Life, proving Ineffectual, we concluded, ſhe had been Dead a full *Minute* before we remov'd her out of the *Water*: So that to Sum up the Event of our *Experiment*, even this *Water-Bird* was not able to *Live* in *Cold Water*, without taking in *Freſh-Air*, above 6 *Minutes*.

Vid. Sup. 1. *Exp.* 2. 5. The *Duckling*, (mentioned above,) having a Competent Weight ty'd to her Legs, was let down into a *Tub* of *Water*. There came our ſtore of *Bubbles* at her Noſtrils, but there ſeem'd to come out more and greater from a a certain place in her Head almoſt equidiſtant from her Eyes, but ſomewhat leſs remote from her Neck than they. After much ſtrugling and frequent gaping, ſhe had divers *Convulſive* Motions, and then let her Head fall down backward, with her Throat upwards. To which moveleſs Poſture ſhe was reduced at the End of the *third Minute*, if not a little ſooner; but a while after there appear'd a manifeſt but tremulous Motion in the two parts of her Bill, which continued for ſome time, but afforded no Circumſtances, whereby we could be ſure, that they were not *Convulſive* Motions; but theſe alſo ceaſing upon the end of the *fourth Minute*, the Bird was taken out and found *irrecoverable*.

From theſe two Experiments it appears, that tho' *Water Fowl* (at leaſt *Ducks*) could not in our *Receivers* endure the want of *Air* much longer than other *Birds*; yet by that Contrivance of Nature mention'd about the *Heart*, they are enabled to continue much longer under *Water*.

6. A *Viper*, that was kept ſo many *Hours* in an *Exhauſted Receiver* till it was concluded to be ſtark *Dead*, and to have been ſo for a good while, was kept all Night in a Glaſs-body upon a warm Digeſtive Furnace: Whereupon the *Viper* was found, the next Morning, to be very *lively*. We then put her into a tall Glaſs-Body fitted with a Cork to the Orifice of it, and depreſſed with Weight, ſo that ſhe could come at no *Air*. And after ſhe had been *duckt* a while, ſhe lay with a very little Motion for a conſiderable ſpace of time. At an *Hour* and a *Quarter* ſhe often put out her black Tongue; at near 4 *Hours* ſhe appear'd much *alive*, and, as I remember, about that time alſo put out her Tongue, *Swimming* all this while, as far as we obſerv'd, above the *Water*. At the end of about 7 *Hours* or more, ſhe ſeem'd yet to have ſome Life in her, her Poſture being manifeſtly changed in the Glaſs from what it was a while before, unleſs that might proceed from ſome difference made in her Body as to Gravity and Levity. Not long after ſhe appear'd quite Dead. Her Head and Tail hanging down moveleſly, and directly towards the bottom of the Veſſel, whilſt the middle of the Body floated as much as the above mentioned Cork would permit it.

I muſt here take Notice, that though ſome of the above mentioned Animals ſeem by the Relations we have given of them, to have been a little ſooner deſtroy'd by *Drowning*, than any we have mention'd were by our *Engine*, yet that is no ſure proof, that *Suffocation* does kill Animals faſter than the *Deprivation* of *Air*, they are expoſed to in our *Engine*. For in *Drowning*, that which deſtroys is applyed to its full Vigour at the very firſt, and all at once: Whereas our *Receivers*, being made for ſeveral Purpoſes, the *Deprivation* of the *Air*, that they make cannot be made all at once, but the *Air* muſt be *Pump'd* out by Degrees; ſo that till the laſt the *Receiver* will be but partly emptied. [For Confirmation of which I have this to alledge, that, having in the preſence of ſome *Virtuoſi*, provided for the Nonce a very ſmall *Receiver*, wherein yet a *Mouſe* could Live ſome time if the *Air* were left in it, we were able to evacuate it at *one Suck*, and by that Advantage we were enabled, to the Wonder of the Beholders, to kill the Animal in leſs than *half* a *Minute*.

Animals in Rarefied Air, n. 63. p. 2036.

XI. 1. *Aug.* 16. A *Linnet* being put into a *Receiver*, capable to hold about Four Pints and a half of *Water*, the Glaſs was well cloſ'd with Cement and a Cover; but none of the *Air* was drawn out with the *Engine* or otherwiſe. And though no new Air was let in, nor any change made in the impriſon'd Air, yet the *Bird* continued there 3 *Hours* without any apparent approach to *Death*; and though it ſeem'd ſomewhat *Sick*, yet being afterwards taken out it recovered, and liv'd ſeveral *Hours*.

2. *Aug.* 18. From the above mention'd *Receiver* about *half* the *Air* was drawn out, a *Linnet* being then in the Glaſs, and in that *Rarefied Air* (which appear'd by a *Gage* to continue in that State) the *Bird* lived an *Hour* and near a *Quarter* before it ſeemed in danger of *Death*; after which the *Air* being let in without taking off the *Receiver*, ſhe manifeſtly recover'd, and leaped againſt the ſide of the Glaſs; being taken out into the *open Air* ſhe flew out of my Hand to a pretty Diſtance.

3. *Sept.* 9. We convey'd into a *Receiver*, capable to hold about $4\frac{1}{2}$ *Pints* of Water, a *Lark*, together with the *Gage*, by the Help whereof we pump'd out of the *Receiver* $\frac{3}{4}$ of the *Air* that was in it before; then heedfully obſerving the *Bird*, we perceived it to pant very much, ſo that a Learned Phyſitian (from whom I yet diſſented,) judged thoſe Beatings to be *Convulſive*: Having continued thus for a little above a *Minute*, and a half; the Bird fell into a true *Convulſive* Motion, that caſt it upon the Back. And although we made great Haſt to let in the *Air*; yet before the Expiration of the *Second Minute*, and conſequently in leſs than *half* a *Minute* from the time immediately preceeding the *Convulſion*, the *Lark* was gone paſt all Recovery.

4. Preſently after we put into the ſame *Receiver* a *Greenfinch*, and having withdrawn the *Air*, till it appeared by the *Gage* there remained but *half*, we took Notice, that, within a *Minute* after, ſhe appeared to be very *Sick*, and ſhaking her Head, threw againſt the inſide of the Glaſs a certain Subſtance, which I took to be Vomit, and which afterwards appear'd ſo; upon this *Evacuation* the *Bird* ſeem'd to recover, and continue pretty well (but not without panting) till about the end of the 4th *Minute*, at which growing very *Sick*, ſhe vomited again (ſhaking her Head as at firſt,) but much more unqueſtionably than before, and ſoon after eat up again a little of her Vomit: at which time (whether that contributed to her Recovery or no, ſhe very much recovered. And though ſhe had, in all, three fits of Vomiting, yet for the laſt 7 or 8 *Minutes* that we kept her in the *Receiver*, ſhe ſeem'd to be much more *lively* than was expected: Which may in part be attributed to a little *Air* that by an Accident got in, tho' it were im-

mediately *Pump'd* out again. At the end of a full *Quarter* of an *Hour* from the firſt Exhauſtion of the *Receiver*, the Bird appearing likely to Die in a great while, we took her out.

5. *April* 12. A *Viper* was included, together with a *Gage*, in a Portable *Receiver*, capable to hold 3½ *Pints* of Water. The Veſſel being Exhauſted, and ſecured againſt the Regreſs of the *Air*, the impriſoned Animal was obſerv'd not only to be *alive*, but nimbly to put out and to draw back its Tongue, about 36 *Hours* after it was firſt ſhut up. At the end of 60 *Hours* as I was going to Bed ſhe appear'd very dull and faint, and not likely to live much longer; the next Day after *Dinner*, I found her ſtark *Dead*, with her Mouth open'd to a ſtrange wideneſs: Wherefore ſuffering *Water* to be impelled by the outward *Air* into the Cavity of the *Receiver*, we found that 4 parts of 5, or rather 5 of 6 of the Veſſelled *Air* had been Pumped out.

Difficult Reſpiration at the Tops of Mountains.

6. I ſhall here add, that, an Eccleſiaſtical Perſon, who had viſited thoſe *high Mountains* of *Armenia*, (on one of which, becauſe of their Height, the Tradition of the Natives will needs have the *Ark* to have reſted;) told me, that thoſe *Mountains* were really exceeding *high*, and that he could not come to the *Top*, (becauſe of the unpaſſable Snows.) And that whilſt he was in the upper part of the *Mountain*, he plainly perceived that he was reduced to fetch his Breath much oftener than he was wont, and than he did before he aſcended the Hill and after he came down from it; and that, having expreſt ſome wonder to find himſelf ſo ſhort winded, the People told him, that it was no more than happen'd to them when they were ſo high above the Plain; it being a Common Obſervation among them. He alſo told me, that he made the like Obſervation upon the *Top* of a Mountain in the Country of *Sevennes*, in or near the Province of *Languedock*.

A Learned Traveller, who was a Perſon very Curious and Intelligent, told me, that being invited, about the Beginning of *September* to viſit a Neighbouring Mountain, that is at leaſt one of the *Higheſt* of the *Pyreneans*, which is commonly call'd *Pic de Midi*, they found the *Air* there not ſo fit for *Reſpiration* as common *Air*, and were fain to breath *ſhorter* and *oftner* than uſual; and becauſe I ſuſpected, that might come from their Motion, I ask'd, whether they obſerv'd it to ceaſe when they came down to the *Bottom* of the *Hill*, which he told me they plainly did; beſides that, they ſtayed many *Hours* at the *Top*, too long to continue out of *Breath*.

It is worth further Inquiry, whether the Sickneſs, if not alſo the Difficulty of Breathing that ſome have been obnoxious to in the uppermoſt parts of *Pariacacha*, and perhaps ſome other *high Mountains*, may not be imputed, not ſo preciſely to the *Thinneſs* and *Rarity* of the *Air* in places ſo remote from the lowermoſt part of the *Atmoſphere*, as to exclude certain *Stean* of a peculiar Nature, which in ſome places the *Air* may be imbued with? For an Intelligent Perſon inform'd me, that he had attempted to go up t the *Top* of the *Pic* of *Teneriffe*: But that, though ſome of the Company we able to do ſo, he and ſome others, before they had reached near ſo *high*, gre ſo *Sick* upon the Operation they felt of the ſharp *Air*, and *Sulphurous Exhalations* which infected it, that they were fain to ſtay behind their Compan this, he having already found this Effect of thoſe *piercing Steams* upon his Face, that the *Skin* began to be of a *pale Yellow*, and even his *Hair* to be diſcoloured.

Animals in the ſame Air, *vary'd as to* Denſity.

XII. We included a *Mouſe* in a fine limber and clear *Bladder*, made more Tranſparent by being anointed with *Oyl*, on the Outſide that the ſmell of it might leſs offend him.

Then, to make up ſo large an Orifice without Wrinkles, (at which the *Rarefied Air* may eſcape) we provided a round ſtick, ſome what leſs than the Orifice, which we laid over with a cloſe and yielding Cement, (for Pitch, or the like common Stuff, will not always ſerve the turn) and ty'd the *Bladder* faſt and cloſe enough upon it, leaving in the *Bladder* as much *Air* as we thought might ſuffice him for as long a time as the *Experiment* was to laſt. Then putting this Limber or *Extenſible Receiver*, if I may ſo call it, into an ordinary one of Glaſs, and placing this *Engine* near a Window, that we might ſee through both of them; the *Air* was by Degrees pumped out of the *External Receiver*, (as for Diſtinctions ſake I ſhall call it,) and thereupon the *Air* included in the *Bladder* did proportionally expand it ſelf, and ſo diſtend the *Internal Receiver*, till being arrived at a Degree of *Rarefaction*, which rendred it unfit for the included *Mouſe's Reſpiration*, I perceived, though with ſome Difficulty, in this Animal the Signs of his being in great Danger of *Sudden Death*. Whereupon the outward *Air*, being haſtily let into the *External Receiver*, compreſſed the ſwelled *Bladder* to its formed Dimenſions, and thereby the *included Air* to its former *Denſity*, by which means the *Fainting Mouſe* was quickly *revived*. Having given him ſome convenient time of Reſpite, the *Experiment* was reiterated with the like Succeſs; and we doubted not but the *third Tryal* we made, would have ended as the two former did: But that, whilſt we were conſidering of the Sickneſs of the *Mouſe*, which, by Reaſon of ſome Opacity that could ſcarce be avoid in the Wrinkled Bladder, was not, as to its Degree, ſo eaſily taken notice of, it grew *irrecoverable* by the ſubſequent *Condenſation* of the *Air*.

The Production *and* Growth *of* Animals, *in an* Exhauſted Receiver.

XIII. 1. We took a good Company of *Tadpoles*, and put them with a convenient *Quantity* of *Water* into a Portable *Receiver* of a round Figure, and obſerv'd, that at the firſt *Exſuction* of the *Air*, they did riſe to the top of the Water though moſt of them ſubſided again, till the next *Exſuction* raiſed them. They ſeem'd by their Active and Wrigling Motion to be very diſcompoſed. The *Receiver* being *Exhauſted* they continued reſtleſs, moving all of them in the top of the Water, and tho' ſome of them ſeem'd to endeavour to go to the Bottom, and dived ſome part of the way, eſpecially with their Heads, yet they were immediately buoyed up again. Within an *Hour* or a little more they were all moveleſs, and lay floating on the Water; wherefore I opened the *Receiver*, upon which the *Air* ruſhed in, and almoſt all of them (which were many) preſently ſunk to the Bottom, but none of them recovered to *Life*.

2. A little after theſe, we included a leſſer Number of *Tadpoles* in a ſmaller Glaſs, which was alſo *Exhauſted* with the like Circumſtances with the former. And when I found the other *Tadpoles* to be *dead* I haſted to theſe which did not, except perhaps one, give any Sign of *Life*, but upon letting in the *Air*, theſe having not been long kept from it, ſome few of them did reco-

ver, and ſwam up and down lively enough for ſome time; though after a while they alſo *Dy'd*.

3. Some years after, I repeated the ſame *Experiment:* And though after the *Exhauſtion* was perfected, the *Tadpoles* did for a while move briskly enough on the top of the *Water*, (none of them appearing able to Dive or Swim under *Water)* yet coming to look on them after the end of an *Hour*, they ſeem'd to be all of them quite Dead, yet continued floating. And though within *half* an *Hour* after that, I let in the *Air* upon them, yet all the Effect of it was, that the moſt of them immediately ſunk to the Bottom, as the reſt of them did a very little while after; none of them, that I could obſerve, recovering any *Vital Motion*.

4. Having, after much watching and with much ado got 4 or 5 of thoſe odd *Aquatick Inſects* whereof *Gnats* are generated, about the end of *Auguſt*, after a Shower of *Rain* which dropt from a Houſe into a Veſſel laid on purpoſe for it, we included them with ſome of their *Water* into a ſmall Glaſs *Receiver*, which being very exactly cloſed we kept in a South-Window, where thoſe little Creatures continued to Swim up and down for ſome few *Days*, without ſeeming to be much incommodated by ſo unuſual an Habitation; and at the end of that time, and much about the ſame Day, they diveſted the Habit they had whilſt they lived as *Fiſhes*, and appear'd with their *Exuviæ*, or caſt Coats, under their Feet, ſhewing themſelves to be perfect *Gnats*, that ſtood without ſinking upon the Surface of the *Water*, and diſcovered themſelves to be *alive* by their Motion, when they were excited to it: But I could not perceive them to *fly* in that *Thin Medium*; to which Inability, whether the *Viſcoſity* of the *Water* might contribute, I know not, though they lived a pretty while, till Hunger or Cold deſtroy'd them.

The Expanſion of Blood and other Animal Juices, and of the Soft Parts of the Body.

1. The warm *Blood* of a *Lamb*, or a *Sheep*, being taken as it were haſtily brought from the Butchers, where the Fibres had been broken to hinder the *Coagulation*, was in a wide Mouth'd Glaſs put into a *Receiver*, made ready for it; and the *Pump* being early ſet on Work, the *Air* was diligently drawn out. After a long Expectation, the more ſubtile parts of the *Blood* would begin to force their way through the more Clammy ones, and ſeem to boyle in large Cluſters, ſome as big as great Beans or Nutmegs; and ſometimes to the wonder of the by-ſtanding Phyſicians, the *Blood* was ſo Volatile, and the Expanſion ſo Vehement, that it boyled over the containing Glaſs; of which, when it was put in, it did not, by our Eſtimate, fill above a Quarter.

Having alſo included ſome *Milk*, warm from the Cow, in a Cylindrical Veſſel of about 4 or 5 Inches high, when the *External Air* was *fully* withdrawn, the white Liquor began to boyle in a way that was not ſo eaſy to deſcribe, as pleaſant to behold: And this it did for a pretty while, with ſo much Impetuoſity, that it threw up ſeveral parts of it ſelf out of the wide mouthed Glaſs that contained it (and could have contained as much more) though there were not above two or three *Ounces* of the Liquor.

A yet greater Diſpoſition to the *Intumeſcence* we thought we obſerv'd in the *Gall*, which was but ſuitable to the *Viſcoſity* of the Texture.

Now,

Note, That the two foregoing Experiments were made with an Eye caſt upon the Inquiry, that I thought might be made, whether, and how far the deſtructive operation of our *Engine* upon the included Animal, might be imputed to this, that upon the withdrawing of the *Air*, beſides the removal of what the *Air's* Preſence contributes to Life, the little *Bubbles* generated upon the abſence of the Air in the Blood, Juices, and ſoft Parts of the Body, may by their vaſt Number and their conſpiring Diſtenſions, variouſly ſtreighten in ſome places, and ſtretch in others, the Veſſels, eſpecially the ſmaller ones, that convey the Blood and Nouriſhment: and ſo by choaking up ſome Paſſages and vitiating the Figure of others, diſturb, or hinder the due Circulation of the Blood? Not to mention the Pains that ſuch Diſtenſions may cauſe in ſome Nerves and membranous Parts, which by irritating ſome of them into Convulſions, may haſten the Death of Animals, and deſtroy them ſooner by Occaſion of that Irritation, than they would be deſtroyed by the bare Abſence, or Loſs of what the Air is neceſſary to ſupply them with. And to ſhew, how this Production of Bubbles reaches even to very minute Parts of the Body, I ſhall add on this Occaſion, (hoping that I have not prevented my ſelf on any other) what may ſeem ſomewhat ſtrange, what I once obſerved in a *Viper*, furiouſly tortured in in our exhauſted Receiver, namely, that it had manifeſtly a conſpicuous Bubble moving to and fro in the wateriſh Humour of one of its Eyes.

2. And to ſhew, that not only the Blood and Liquors, but alſo the other ſoft parts, even in cold *Animals*, have aerial Particles latitant in them, we took the *Livers* and *Heart* of an *Eel*, as alſo the *Head* and *Body* of another *Fiſh* of the ſame kind, cut aſunder croſs-ways ſomewhat beneath the *Heart*, and putting them into a *Receiver*, upon the withdrawing of the *Air*, we perceived that the *Liver* did manifeſtly ſwell every way, and that both the upper and lower Parts did ſo likewiſe; and at the place where the Diviſion had been made, there came out, in each Portion of the *Fiſh*, divers *Bubbles*, ſeveral of which ſeem'd to come from the *Medulla Spinalis*, or the Cavity of the *Back bone*, or the adjoining Parts, and the external Air being let in, both the portions of the *Eel* preſently ſhrunk, ſome of the Skin ſeeming to be grown empty or flaccid in each of them.

Aſſuefaction to rarefied Air.

XIV. 1. We included in a round Vial with a wide Neck, (the whole *Glaſs* being capable of containing about 8 Ounces of *Water*) a young and ſmall *Mouſe*, and then tied ſtrongly upon the upper part of the *Glaſs*'s Neck a fine thin *Bladder*, out of which the *Air* had been carefully expreſſed, and then conveyed this phantaſtical Veſſel into a middle ſiz'd *Receiver*, in which we alſo plac'd a *Mercurial Gage*. The *Air* was by degrees pumped out, till it appeared by the *Gage*, that there remained but a 4*th* part in the *external Receiver*, (as for diſtinction Sake I call it;) whereupon the *Air* in the *external Receiver* expanding it ſelf, appear'd for to have blown the *Bladder* almoſt half full, and the *Mouſe* ſeemed very ill at Eaſe by his Leaping, and otherwiſe endeavouring to paſs out at the Neck of his uneaſy Priſon; we did for fear the over thin Air would diſpatch him, let the Air flow into the *external Receiver*, whereby the *Bladder* being compreſs'd, and the *Air* in the Vial reduced to its former *Denſity*, the little Animal quickly recover'd.

2. A while after, without removing the *Bladder*, the *Experiment* was repeated, and the *Air* by the help of the *Gage*, was reduced to its former Degree of *Rarefaction*; and the *Mouſe* was kept in that thin Air for full 4 *Minutes*; at the end of which he appeared ſo ſick, that to prevent his dying immediately, we remov'd the *External*, and took out the *Internal Receiver*. Whereupon, tho' he recovered, yet 'twas not without much Difficulty; being unable to ſtand any longer upon his Feet, and for a great while after continued manifeſtly trembling.

3. But having ſuffered him to reſt a reaſonable ſpace of time, preſuming that *Aſſuefaction* had accuſtomed him to greater Hardſhips, we convey'd him again into the *external Receiver*, and having brought the *Air* to the former Degree of *Expanſion*, we were able to keep him there for a full Quarter of an Hour. And 'tis worth noting, That till near the latter End of the quarter of an hour, not only the *Animal* did ſcarce at all appear diſtreſſed, remaining ſtill very quiet; but which is more, whereas when he was put in, the Tremblings formerly mention'd were yet upon him, and continued ſo for ſome Time yet afterwards, in ſpight of the *Expanſion* of the *Air* he was then in, they left him early enough. And when the *Internal Receiver* was taken out, he did not only recover from his fainting Fit ſooner than before, but eſcaped thoſe ſubſequent Tremblings.

4. After we had allow'd him ſome time to recollect his Strength, we reconveyed him into the *Receiver*, and pump'd out the *Air*, till the *Mercury* in th *Gage* was not only drawn down as low as formerly, but near half an Inc lower. And tho' this did at firſt ſeem to diſcompoſe our little Beaſt, ye after a while he grew very quiet, and continued ſo for a full Quarter of a Hour, when we cauſed 3 *Exſuctions* more to be made by the Pump, before we diſcovered him to be in manifeſt Danger (at which time the *Bladd* appeared much fuller than before:) But then we were oblig'd to let th *Air* into the outward *Receiver*, whereupon the *Mouſe* was more ſpeedily revived than one would have ſuſpected.

And theſe *Trials* of the power of *Aſſuefaction* ſeem'd the more conſiderab becauſe the *Air*, in which the *Mouſe* had all this while lived, had been clo ged and infected with the *excrementitious Effluviums* of his Body, for 'twas th ſame all along, we having purpoſely forborn to take off the *Bladder*.

Unfit for Reſpiration, *yet* retaining *its* Denſity.

XV. 1. We took a *Mouſe* of an ordinary Size, and having, not witho ſome difficulty, conveyed him into an oval Glaſs fitted with a ſomewhat lon and conſiderably broad Neck, we conveyed in after him a *Mercurial Gage*, i which we had diligently obſerv'd and marked the Station of the *Mercury* and which was ſo faſtned to a *Wire* reaching to the bottom of the *Oval Glaſ* that the *Gage* remaining in the *Neck*, was not in danger to be broken by th Motions of the *Mouſe* in the oval Part: The upper part of the long Neck o the Glaſs was, notwithſtanding the wideneſs of it, *Hermetically ſeal'd*: An tho' by Reaſon of the largeneſs of the Veſſel in compariſon of ſo ſmall a

Animal,he ſeem'd to me rather drooping than very near death at the end of the *ſecond Hour*; yet coming to look upon him about *half* an *Hour* after, he was judg'd by the Spectators quite dead, notwithſtanding our ſhaking of the Veſſel to rouze him up. This made me caſt my Eyes upon the *Gage*, wherein I could not perceive any ſenſible Change of the *Mercury*'s Station. But having cauſed the ſeal'd part of the Glaſs to be broken off,and freſh *Air* to be blown in by a pair of Bellows, the gaſping Animal revived, tho' but ſlowly.

2. Such an Experiment as the former we made with like Succeſs upon a ſmall Bird, included with a *Gage* in a *Receiver*, holding about a Quart of Water. The *Bird* in about half an Hour appeared to be ſick and drooping, and the Faintneſs and Difficulty of *Breathing* increaſed for about 2 Hours and an half after that, at which time the Animal died, the *Gage* being not ſenſibly altered.

3. In a *Glaſs Vial*, capacious enough to hold about 3 quarts of *Water*, we *Hermetically* ſeal'd up a ſmall Bird, and found, that in a few *Minutes* he began to be ſick and pant; which *Symptoms* I ſuffered to continue and increaſe againſt the Mind of a learned *By-ſtander*, who thought the Animal would not hold out ſo long, till they had laſted juſt half an hour; at which time having provided a veſſel of *Water*, made exceeding cold with *Sal-Armoniack*, newly put into it, the *Vial* with the ſick *Bird* was immers'd in it, and kept there in that Condition for 6 Minutes; and yet it did not appear, that this great *Refrigeration* did ſenſibly refreſh the drooping Animal. So that this remedy proving ineffectual, the *Vial* was removed out of the *Water*, and the *Bird* ſometime after did, as I foretold, make many Strains to vomit, (tho' ſhe brought up little) followed by *Evacuations* downward, before ſhe quite expired, which ſhe did within a Minute or two of a juſt Hour, after the beginning of her Impriſonment.

The uſe of Air in Reſpiration.

XVI. We made by *Diſtillation* a Blood red Liquor, which I have with very little variation communicated in the *Hiſtory of Colours*, and which chiefly conſiſts of ſuch *ſaline* and *ſpirituous* Particles as may be obtained from the *Maſs* of *Blood* in human Bodies; this *Liquor* is of ſuch a Nature, that if a *Glaſs-Vial*, about half fill'd with it, be kept well ſtopp'd, the red Liquor will reſt as quietly as any ordinary one, without ſending up any Smoke or viſible Exhalation; but if the *Vial* be unſtopped, ſo that the *external Air* be permitted to come in and touch the Surface of the Liquor, within a Quarter of a Minute or leſs, there will upon this Contact be elevated a copious white Smoke, which will not only fill the upper part of the Glaſs, but plentifully paſs out into the open Air, till the *Vial* be again ſtopped. This *Experiment* may ſerve to illuſtrate the Office of the *Air* to carry off in *Expiration* the *fuliginous Steams* of the *Lungs*. For, in our Experiment we manifeſtly ſee, that the very *Contact* of the *Air* may give the *Corpuſcles* of moiſt Bodies a peculiar Volatility, or Facility to emerge in the Form of *Steams*. It may here ſuffice to take notice of theſe two things: The one is, That when the *Vial* has lain ſtopped and quiet a competent time, the upper half of it will appear deſtitute of *Fumes*, of which the *Air*, it ſeems, will imbibe, and conſtantly retain but a certain moderate quantity, which may give ſome Light towards the reaſon, Why the ſame *Air*, which will be quite clogged with *Steams*, will not long ſerve for *Reſpiration*, which requires frequent ſupplies of freſh *Air:* The other is, That if the *unſtopped Vial* were placed in our *Vacuum*, it would not emit any viſible Steams at all, nor ſo much as to appear in the upper part of the Glaſs it ſelf that held the Liquor; whereas, when the Air was by degrees reſtored at the *Stopcock*, without moving the *Receiver* it ſelf, to avoid injuring its cloſeneſs, the returning Air would preſently raiſe the *Fumes*, firſt into the vacant part of the *Vial*, whence they would aſcend into the Capacity of the *Receiver*; and likewiſe, when the Air that was requiſite to ſupport them was pumped out, they alſo accompanied it, as their unpleaſant Smell evinced, and the red Spirit, tho' it remain'd unſtopped, emitted no more *Fumes* till the Air was let in.

Snails, Efts, *and* Leeches. XVII. 1. Two *white Snails without Shells* of differing ſizes, (the biggeſt about an Inch and a half, and the other about an Inch in length) were included in a ſmall portable *Receiver*, which was carefully *exhauſted*, and ſecured againſt the Return of the *Air*. Preſently after 'twas remov'd from the *Engine*, it was eaſy to diſcern that both the *Snails* thruſt out and retracted their Horns (as they are commonly call'd) at pleaſure, tho' their Bodies had in the ſofter places pretty ſtore of newly generated *Bubbles* ſticking to them: But tho' they did not loſe their Motion near ſo ſoon, as other *Animals* were in our *Vacuum* wont to do, yet coming to look on them after ſome Hours, they appear'd moveleſs and very tumid, and at the end of 12 *Hours*, the inward parts of their Bodies ſeemed to be almoſt vaniſhed and they ſeemed to be but a couple of ſmall full blown Bladders; and on the letting in of the Air, they immediately ſo ſhrunk, as if the Bladders having been pricked, the receeding Air had left behind it nothing but Skins; nor did either of the *Snails* afterwards, tho' kept many Hours, give any Signs of Life.

2. We included in a *Receiver*, whoſe globular part was about the Bigneſs of a large *Orange*, one of that ſort of *Animals* that they vulgarly call *Efts*: Having withdrawn, but not ſolicitouſly, the Air, we kept him there abou 48 Hours: during all which time he continued alive, but appeared ſomewhat *ſwelled* in his Belly; his under-chap moving the very firſt Night, bu not the Day and Night following. By opening the *Receiver* at length unde Water, we perceived, that about half the Air had been drawn out. As ſoo as the Water was impelled into the Glaſs, the *Animal* that was before du and torpid, ſeem'd, by very nimble and extravagant motions to be ſtrang ly revived

3. We took a *Leech*, that was of a moderate bigneſs, or ſomewhat ſhort it, and having included it together with ſome *Water* in a portable *Receiv* that was gueſs'd to be capable of holding about 10 or 12 *Ounces* of that liquo the *Air* was pump'd out after the uſual manner, and the *Receiver* being r mov'd to a lightſome place, we obſerved, as we expected, that the *Leech* kee ing her ſelf under Water, there emerged from divers parts of her Body ſto of *Bubbles*, ſome of them in a diſperſed Way, but others in *Rows* or *Files*, i may ſo ſpeak, that ſeem'd to come from determinate Points. Though th Production of *Bubbles* laſted a pretty while, yet the *Leech* did not ſeem to

ve

very much *diſcompoſed* by her preſent Condition: For after 5 Days (tho' the *Receiver* continued well exhauſted) we found her very lively.

Creeping Inſects.

XVIII. 1. We took 5 or 6 *Caterpillars* of the ſame ſort; and had the *Air* drawn from them, and carefully kept from returning. About an Hour after, I found them moving to and fro in the *Receiver*, and even above two *Hours* after that, I could by ſhaking the Veſſel, excite in them ſome Motions, that I did not ſuſpect to be convulſive. But about 10 Hours after they were firſt included, they ſeem'd to be quite dead; yet the *Air* being forthwith reſtored to them, I found the next *Day*, that 3 or 4 of them were perfectly alive.

2. We took from a Hedge a Branch that had a large *Cobweb* of *Caterpillars* in it, and having divided it into two parts, we put them into like *Receivers*; and in one of them ſhut up the *Caterpillars* together with the *Air*, which from the other was exhauſted. The Event was, that in that which had the *Air*, the little and difficultly viſible *Inſects*, after a ſmall time, appeared to move up and down as before and ſo continued to do for a Day or *two*, whereas that Glaſs whence the *Air* had been drawn out, and continued kept out, ſhewed after a very little while, no Motion that we could perceive.

Winged Inſects.

XIX. 1. *Nov.* 12. 8 *at Night.* There were taken 4 middle ſiz'd *Fleſh-flies*, which having their Heads cut off, were incloſed in a portable *Receiver*, furniſhed wich a pretty large Pipe and a Bubble at the end. As ſoon as the *Receiver* was exhauſted, thoſe *Flies* loſt their Motion (which was not brisk before;) an *Hour* or *two* after, I approached them to the Fire, which reſtored not their Motion to them (but as to one of them I ſuſpected it had a languid Motion for a while); Wherefore I let in the Air upon them, after which, in a very ſhort time, tho' not immediately, they began one after another to move their Legs, and *One* or *Two* of them to walk.

2. *Sept.* 11. *About Noon.* We cloſed up divers ordinary *Flies*, and a *Bee* or *Waſp*; all which, when the *Air* was fully *withdrawn*, lay as dead, ſave that for a very *few Minutes* ſome of them had convulſive Motions in their Legs, They continued in this State 48 Hours, after which, the *Air* was let in upon them, but none of them recovered.

3. *Decem.* 11. at Night, we put a great *Fleſh-Fly* into a very ſmall portable *Receiver*, where at firſt it appear'd to be very brisk and lively, but as ſoon as the *Air* was *drawn* out, fell on his back, and ſeemed to have Convulſive Motions in her Feet and *Proboſcis*, from whence ſhe preſently recover'd, upon the letting in of the *Air*, which being *drawn* out again, ſhe lay as dead, but a While after, (within a quarter or half an Hour) I perceived, that upon ſhaking the *Receiver*, ſhe ſtirred up and down, but faintly. The next Night, by Warmth and letting in the *Air*, the *Fly* recovered: But being next Morning *ſeal'd up* again in that Glaſs, and kept 48 Hours, tho' over the Chimney, ſhe died for good and all.

4 We took a large *Graſs-hopper*, whoſe Body, beſides the Horns and Limbs, was about an Inch in length, and of a great thickneſs in proportion to that length: This we conveyed into a portable *Receiver* of an oval Form,

and capable of holding, by our gueſs, about a pint of *Water*, When the *Air* began to be conſiderably rarefied, he appeared to be very ill at eaſe, and ſeemed to *ſweat* out of the *Abdomen* many little drops of liquor, which being united, trickled down the glaſs like a little ſtream, which made at the bottom a ſmall Pool of clear Liquor, amounting to near a *quarter* of a *Spoonful*, and by that time the *Receiver* was ready to be taken off, the *Graſs-hopper* was fallen upon his Back, and lay as dead, and continued ſo for 3 *Hours*, After which, the *Air* being let in upon him, he continued without any Signs of Life for a quarter or half an *Hour* : but being carried to a ſun-ſhiny Place, the Beams of a declining Sun preſently began to make him ſtir his *Limbs*, and in a ſhort time brought him perfectly to Life again.

5. *Apr.* 15. We took one of thoſe *ſhining Beetles* they call *Roſe-Flies*, and having included it in a very ſmall round *Receiver*, which we *exhauſted* ; and tho' it ſtruggled much whilſt the *Air* was withdrawing, yet preſently after, I could perceive but little Motion (and part of that ſeem'd almoſt convulſive.) About 6 Hours after, it ſeem'd quite dead, and upon the Return of the Air, no Sign of Life enſued for a pretty While, but 3 or 4 Hours after, I found him lively enough.

6. Having obſerved *Butterflies*, not only to *live*, but to *move* longer than was expected; I included divers of them in ſomewhat large *Receivers*, and tho' whilſt the *Air* continued in the *Glaſſes*, they *Flew* actively as well as freely up and down ; and tho' after the *Exhauſtion* of the *Air*, they continued to Live, and were not moveleſs ; nay, tho' at the bottom of the *Receiver*, they would even move their Wings, and a little flutter ; yet I could not perceive any of them to fly, by which, I mean, perform any progreſſive Motion ſupported by the Medium only. And by frequently inverting the *Receiver* (which I took Care ſhould be pretty long, to let them fall from one extream to the other) they would fall like dead Animals, without diſplaying their Wings, tho' juſt as they came to touch the bottom, ſome of them would ſometimes ſeem to make ſome uſe of them, but not enough to ſuſtain themſelves, or to keep their Falls from being rude enough.

Ants and Mites.

XX. 1. A pretty Number of *Ants* were included in a ſmall portable *Receiver*, exhauſted yeſterday about Noon. They grew almoſt moveleſs as ſoon as the Air was exhauſted: And between 6 and 7 in the Afternoon, they ſeem'd to be all quite dead. Whereupon I opened the Glaſs, and tho no Sign of Life appeared for a great while, yet this Morning I found many of them alive and moving to and fro.

2. We conveyed a pretty Number of *Mites*, which are reputed but Living Points, together with the mouldy Cheeſe they were bred in, to nouriſh them, into 3 or 4 very ſmall *Receivers*. One of them with the Air in it was ſeal'd up at a Lamp Furnace, and from all the reſt we *withdrew* the Air This done, we obſerv'd the following *Phænomena*, viz.

1. Thoſe *Mites* that were incloſed in the ſmall Glaſs that never came ne the Engine, continued alive, and able to walk up and down for above full Week, after they had been put in, and poſſibly would have continue much longer, if the Glaſs had not been broken.

2. Though juſt before the *withdrawing* of the *Air*, the *Mites* were ſeen to move up and down in it; yet within a few *Minutes* after the *Receiver* was applied to the Engine, I could diſcern in them no Life at all, tho' my Eye was aſſiſted with a double convex Glaſs. About an Hour after, I could not perceive any of them to ſtir; 2 or 3 Hours after that, I let in the Air, and left the *Receiver* unſtop'd in a *Window*.

3. About 2 or 3 Days after, I found a Number of my little Animals revived, as an attentive Eye might eaſily perceive by the Motion of certain little white Specks, and they continued to appear alive for 2 or 3 Days after that, if not longer.

4. One of the *Receivers* was kept exhauſted from *Monday* to *Thurſday*; after all which time, our attentive Eyes being unable to diſcover any Signs of Life among the included Mites, the Air was let in upon them, and after a long time, I could plainly ſee them creep up and down in the Glaſſes again.

Experiments *about the* Weakned Spring, *and ſome unobſerved* Effects; *of the* Air, *by* Mr. Rob. Boyle n. 120 p. 467.

LXXVIII. We took Filings of crude *Copper*, and put them into a cryſtalline Glaſs of a Conical Shape, into which we poured ſome ſtrong Spirit of *Salt*, (that was fitted for our peculiar purpoſe) to the height of about a fingers breadth above the *Filings*, and then cloſing the Veſſel with a Glaſs-ſtopple, exquiſitely fitted to it, we ſuffered it to continue unmoved in a *Window* for ſome Days, till the Liquor had both obtained a high and darkiſh brown Colour, by the Solution of ſome of the *Copper*, and loſt that Colour again, growing clear like common Water (which is it ſelf a ſomewhat odd *Phænomenon*), and then taking out the Stopple, without ſhaking the Liquor, and thereby giving Acceſs to the *outward Air*, we perceived, as we had conjectured) that the upper Surface of the Liquor did in a *few Minutes* re-acquire a darkiſh *Brown* Colour, which penetrating deeper and deeper, at the End of about a quarter of an Hour, the whole Body of the Liquor appeared to be likewiſe tinged The conical Glaſs being again well ſtop'd, the *Menſtruum* did again in very few Days let fall, or otherwiſe loſe its *Tincture*, which the Stopple being taken out, it regained as before. Nor were theſe 2 the only Trials I made with the like Succeſs for the main; but afterwards, being deſirous by a further Trial to reſolve a Doubt I had, I kept the Glaſs yet longer in the ſame place with the ſame *Filings* and *Menſtruum* in it, for if I miſremember not, a *Month* or *two* together; but obſerved not that the Liquor would any more grow clear.

2. Having taken another conical Glaſs, wherein the Liquor was grown clearer than is uſual, and had probably been ſo a good while before, for the Veſſel having been hid by others which ſtood before it, had been for ſome Weeks forgotten; we took out the Stopple, and left it out for about half an Hour, but did not perceive the Liquor to have acquired any colour, ſo much as at the top. But putting in the little Stopple, I left the Veſſel cloſed for 2 or 3 Hours, and at my Return to viſit it, I perceived, that it had acquired a faint Colour tending to a green; Wherefore, taking out the Stopple again, I opened its Commerce with the *outward Air*, leaving the *Glaſs* unſtopt for near 24 hours, but found that in all that time it had not regained it's

wonted dark Colour, but was only arrived at a green, deep enough, but not true nor very tranſparent.

This Obſervation being made in the ſame Veſſel that had been formerly employed, ſuggeſted to us an Enquiry, Whether the advanced Time of the Year, which was the middle of *October*, might not have an Intereſt in the *Slow* and *Imperfect* Succeſs of this Trial?

3. Some ſtrong *Spirit* of *Salt* having been kept upon *Filings* of *Copper* till the Solution was come to be of a dark *Brown* Colour, about Three Spoonfulls of it, by gueſs, was put into a *Receiver* that might hold 8 or 10 times as much: Being kept *in Vacuo*, if the Time be rightly remember'd, about half a Year, it retain'd its Colour, but the Veſſel being open'd, and the external Air permitted a free Acceſs to it, the Solution in about an Hour was turned into a fine tranſparent Green, tho' no Precipitation of any muddy Subſtance appeared by any Sediment to be made.

4. In one of that ſort of *Conical Glaſſes* that has been already deſcrib'd, we had put upon ſome *Filings* of *Copper* a convenient quantity of our *Spirit* of *Salt*, and tho' we obſerv'd, that for a great While it would not part with its *deep* and ſomewhat *muddy Tincture*; yet we left it in the *Window* for many *Weeks* longer, and at length to'ards the latter end of *December*, we found it to have loſt its *Tincture* ſo much, that the Liquor appeared like common *Water*. Upon which Obſervation, tho' the Time of the Year were unpromiſing, I thought fit to try whether the Air in that Seaſon would not have ſome, tho' perhaps but a ſlow Operation on the *Saline Spirit*, and accordingly taking out the Glaſs Stopple to give free Acceſs to the *outward Air*, we obſerv'd, that in ſome Hours its Operation on the Liquor was ſcarce ſenſible; but within about 24 Hours, the *Menſtruum* had acquired not juſt its former Colour, but a ſomewhat faint and moderately tranſparent Green: So that this tincted *Menſtruum* as it had been very ſlow in loſing its Colour, ſo it did but ſlowly and imperfectly reacquire it.

5. We took ſome *Filings* of *Copper*, and putting them, together with a *Mercurial Gage*, in a *Conical Glaſs* fitted with an exactly ground Stopple of the ſame matter (which was *Cryſtalline*) We poured on the *Filings* as much rectified *Spirit* of *Fermented Urine* made *per ſe*, as ſufficed to ſwim an Inch or better above them; then carefully ſtopping the Glaſs, coming to look on it many hours after, we perceived that the *Mercury* in the ſeal'd Leg was conſiderably depreſt, and gently drawing out the Stopple, to let in the *outward Air*, we perceived that Acceſs to have a manifeſt Effect upon the *Mercury*.

6. We took a *Cryſtal Glaſs* of an almoſt *Conical Shape*, and capable of containing between 5 or 6 Ounces of *Water*, and furniſh'd with a ſtopple of the ſame matter, that by grinding was exactly fitted to it. Into this we put a conſiderable Quantity of clean *Filings* of good *Copper*, on which we poured as much ſtrong *Spirit* of *fermented*, or rather *putrify'd Urine*, as ſerved to ſwim about an Inch above the *Copper*, and having let down a *Mercurial Gage*, ſo that it lean'd upon the bottom and ſide of the *Glaſs*, we cloſ'd it very well with a Stopple, and ſet it in a quiet and well enlightned place, having taken good

notice at what Mark the *Quick-ſilver* reſted in the *open Leg* of the *Gage*. This done, we let the *Menſtruum* alone to work upon the *Filings*; which it did as we foreſaw, ſomewhat ſlowly and very calmly without producing any *Noiſe* or ſenſible *Bubbles*, acquiring by degrees a very pleaſant *Blew* Colour, and the Glaſs being kept quiet in the ſame place for 2 or 3 *days* longer, the Liquor, as I conjectured would happen, began to loſe of the *Intenſeneſs* of it's *Colour*, which by Degrees grew fainter and fainter, till at the end of 3 or 4 *Days*, the Liquor was grown very *Pale*, and left me little doubt but that, if I would have ſtaid ſome *days* longer, it would have loſt the remaining Eye of *Blew*, and have lookt almoſt like common *Water*. But being unwilling to tarry ſo long, I took out the Stopple, that the *Air* without the Glaſs might have acceſs to that within; and leaving the Vial in the ſame place and poſture, my expectation was ſomewhat anſwered by finding, that within 4 or 5 *Minutes*, if not leſs, the upper part of the Liquor, that was *Contiguous* to the *Air*, had acquired a fine *Blew Colour*, which deſcending deeper and deeper, before the End of the 10*th Minute* had diffuſed it ſelf, but ſomewhat weakned, through the Liquor, whoſe Colour was ſuffered to deepen for a while longer; ſo that in leſs than a *quarter* of an *hour* from the firſt unſtopping of the Vial the Liquor was grown to be throughout of a rich *Ceruleous* Colour, which grew almoſt too opacous within a few *Minutes* longer: When carefully cloſing the Vial again with the ſame Stopple as before, we ſet it aſide in the ſame place, where, the *Included Air* being denied all Commerce with the *External*, the Liquor began again within 2 or 3 *days* to loſe of its Colour; and, to be ſhort, afforded me the opportunity of making a 2*d* Experiment much like the former. And the like ſucceſs I had, for the main, in a Tryal or two made in another Glaſs with another portion of the ſame *Spirit* of *Urine*, put upon the *Filings* of *Copper*; ſo that the Experiment was, in all, made divers times, as well when I was not, as when I was alone: And particularly, once to be ſure that the Diurnal Air as ſuch had not any great Intereſt in the *Phænomenon*: I made the Tryal ſucceſſively about Nine a Clock at Night.

In moſt of theſe Experiments I forbore to ſhake the Glaſs, leſt it ſhould be ſuſpected, that the Agitation of the Liquor might have raiſed ſome little fine powder that might have been ſuppoſed to have been *Precipitated* out of the Tincture, and, being thus mingled with the Liquor again, Reſtore it to its former Colour; but in truth I did not perceive any ſuch powder to be *Precipitated*. And though to obviate the Objection, I forbore to ſhake the Vial, yet I juſtly ſuppoſed, that if, by the Agitation of the Liquor, more parts of it ſhould be quickly expoſed to the Action of the Air, the Coloration would be haſtned, which upon Tryal appear'd to be true.

7. We took ſuch a Conical Glaſs, as has been lately deſcrib'd, and covering the bottom of it with a convenient quantity of *Filings* of good *Copper*, we poured on them as much ſtrong *Spirit* of *Sal Armoniack* as ſerved to ſwim about a Fingers breadth above them; and, having let down ſuch a *Mercurial Gage* as is formerly mentioned, ſo that it leaned upon the bottom and ſide of the Glaſs, we cloſed it very well with a Stopple, and ſet it in a quiet

and well enlightn'd place, having taken good notice at what mark the *Quick-ſilver* reſted in the open Leg of the *Gage:* This done, we let alone the *Menſtruum* to work upon the *Filings*, which it did, as we foreſaw, ſomewhat ſlowly and very calmly, without producing any *Noiſe* or ſenſible *Bubbles*, acquiring by degrees a very pleaſant *Blue* Colour, and afforded us alſo the *Phænomenon* we chiefly lookt after; which was, that repairing from time to time to the Window to ſee what paſt, we perceived, that for 2 or 3 *days* together the *Mercury* in the *Seal'd* Leg of the *Gage* did, though very ſlowly, *Deſcend* till it appeared to be near a *quarter* of an *Inch* lower than at firſt; and probably the Depreſſion might have been greater, if the Experiment had not been diſturbed; whoſe Event yet ſeemed ſufficiently to argue, that the *Spring* of the *Air* contained in the Cavity of the Glaſs, and communicating with that in the *open Leg* of the *Gage* or *Syphon*, was *Weaken'd* in compariſon of that in the *cloſed Leg*, which by the *Hermetick Seal* on one ſide, and the *Quick-ſilver* on the other, was kept from ſuch Communication. And I was further careful to obſerve, whether the *Depreſſion* did not continue at differing times of the *Day*. and found it to do ſo, as well at *Night* as at *Noon*, though at this laſt named time the *Sun ſhined* hot upon the place and *Veſſels* too.

This Experiment was made, in all 4 or 5 times, though not always with equal, yet ſtill with ſome Succeſs, the *Mercury* in the *Seal'd Leg* of the *Gage* being ſometimes more and ſometimes leſs, but always manifeſtly *Depreſt*; which *Phænomenon* was confirmed, by the Obſervation, we more than once made of the ſudden Return of the *Quick-ſilver* to it's former ſtation, upon the Unſtopping of the Glaſs, to give free admiſſion to the *Outward Air.*

8. A *Mercurial Gage* having been put into a Conical Glaſs, whoſe bottom was covered with beaten *Coral*, ſome *Spirit* of *Vinegar* was poured in, and then the Glaſs Stopple, which was very well ground, cloſing the Neck exactly, we obſerved, that upon the Working of the *Menſtruum* on the *Coral* Store of *Bubbles* were for a good while produced, which ſucceſſively broke in the Cavity of the Veſſel; and their Acceſſion ſo conſtipated the *Air*, that they *compreſt* the *Air* impriſoned in the cloſed Leg of the *Gage* three Marks for Diviſions which I gueſſed to amount to about the *third part* of the Extent it had before: But ſome *hours* after the *Corroſion* had ceaſed, the *Compreſſion* made by this newly generated *Air*, grew manifeſtly fainter, and the impriſoned *Gage Air* drove down the *Mercury* again till 'twas *Depreſt* within one Diviſion of its firſt ſtation; and thereabouts, or a little lower, continued 5 or 6 *Days*; ſo that in this Operation there ſeemed to have been a double *Compreſſive* Power exerciſed; the one Tranſient, by the brisk agitation of *Vapours* or *Exhalations*, and the other Durable, from the *Aerial* and *Springy* Particles, either Produced or Extricated by the Action of the *Spirit* of *Vinegar* upon the *Coral.*

But a pretty Quantity of *Spirit* of *Vinegar* being put upon *Minium*, it continu'd divers *days* without any ſenſible *Depreſſion* of the *Mercury* in either Leg, nor did any Change appear in the *Gage*, upon the Removal of the Stople, thought 'twas evident by the great ſweetneſs acquired, that it had made a *Solution* of a great portion of the *Minium.*

9. We took ſome *Filings* of *Copper*, and in a Vial capable of holding ſome 2 or 3 *Ounces* of Water, we poured on them ſtrong *Spirit* of *Sal Armoniack* made without *Quicklime*, till the Liquor reached near an Inch above them. This was done about the 20*th* of *Auguſt* on the *Friday* before Noon, and the *following Monday* preſently after Dinner it had acquired a deep *Blue* Tincture, and loſt again ſo much of it, that it was Pale almoſt like common Water: Then to ſatisfie a *Virtuoſo*, I unſtopt the Vial, deſiring him to place his Eye level with the Surface of the Liquor, which in a *Minute* of an *Hour* or leſs appeared to his Surpriſe and Wonder, to have acquired a deed *Blue Tincture*, that reached *downwards* to the thickneſs of the back of a Knife, the whole Liquor becoming of the like Colour in 4 or 5 *Minutes* more, and the Glaſs being preſently ſtopt again, and left where 'twas before, appeared not at the end of 9 Days to have loſt its *Tincture*; though now and then within that time, it ſeemed manifeſtly *Paler* than when the Vial was ſtopt.

10. We took a round Vial, holding about 8 *Ounces* of Water, and having put into it *Filings* of *Copper* and a *Mercurial Gage*, we poured on the Metal ſtrong *Spirit* of *Sal Armoniack*, till it reached to a good height in the Vial, which then being *Hermetically Sealed* up, was ſet by in a South *Window*, where it quickly acquired a deep *Blue* Tincture: There it ſtood about 12 Days, before that *Tincture*, which decayed but ſlowly, did little by little grow ſo Diluted that the Liquor was Pale and almoſt like *Water*; during this ſtay of the Glaſs in the *Window*, the *Mercury* in the *Open* Leg appeared to be *Impell'd* up; and when after 9 a Clock at Night (which time I choſe to try whether the *Nocturnal Air*, would have any thing to do with the *Phænomenon*) the *Hermetick Seal* was broken off; immediately upon which there was produced a *Noiſe*, and the *Mercury* in the ſhorter and cloſed Leg was briskly *Impelled* up, by our gueſs near ½ of an *Inch* and though the Orifice at which the Air had Acceſs was ſcarce *wide* enough to admit a middle ſiz'd Pea, yet within a *Minute* and *half* the Surface of the Liquor being held between the Eye and the Candle, appeared to have acquired a very Lovely and Fair *Colour*, which reached downwards a quarter of an Inch; ſo that the Vial ſeemed to contain two very differing Liquors Swimming one on another; and the Coloration piercing deeper and deeper within 5 Minutes in all, the whole Liquor had attained a rich *Blue Colour*.

Pneumatical *Experiments*, by M. Papin: *Directed by* M. Hugens, n. 119. p. 443.

LXXIX. 1. To Mingle divers Liquors together by means of the Air Pump, there were employed two ſmall Glaſſes, whereof the one could enter into the other, and the leaſt of the *two* was faſten'd to the Hook of an *Iron Wire*, and the greater put under it, and the ſaid *Wire* was ſo ordered, that theſe *two* Glaſſes were a little diſtant one from another. The *Recipient* was of a Cylindrical Figure, of which one end is all open, to be faſtned to the Cement of the *Pump*; the other is all cloſed, except a ſmall Hole, having a little Edge or Brim; through which Hole you paſs the hook'd *Iron Wire* and tye an *Eel-Skin*, cloſe about the ſame; and three or four Inches higher, the ſame *Skin*, is alſo to be tyed about the *Iron-Wire*, to keep the *External Air* from entering into the *Recipient*, and yet without taking away the Liberty to ſtir therein what you will by means of the *Iron Wire*, that hath a Communication *Inwards* and *Outwards*. For this purpoſe you muſt chuſe that part of the *Eel-Skin* that is next to the Head, the other part being pierced with many *Holes* with *Valves* that do not always ſhut well.

To be the more ſure, that no Air enters by the Ligatures of the *Eel-Skin*, you may apply a Tube on the *Recipient* with Cement, and pour Water into this Tube until the *Eel-Skin* be quite cover'd therewith. Care alſo muſt be had, that the Hole be exactly filled up by the *Iron-Wire*; for, if it were too big, the *Eel Skin* would be thruſt into it with great violence, and ſo hinder the Liberty of Raiſing and Sinking it.

When the *Recipient* was evacuated of Air, the leſſer Glaſs was by the *Iron-Wire* let down into the greater, until the Liquors they contain, did Mingle themſelves. Thus ſome *Aqua-fortis* was poured into the upper Glaſs, and *Spirit* of *Wine* into the lower, and the *Recipient* was ſo well Exhauſted of Air, that the *Spirit* of *Wine* boyled up with great Bubbles (as uſually it doth) and the *Aqua-fortis* caſt ſome ſmall Bubbles. After that both theſe Liquors were well *purged* of *Air*, the upper Glaſs was ſunk into the lower, ſo as that the *Spirit* of *Wine* was Mingled with the *Aqua-fortis*, at which Inſtant there was yet ſeen a very conſiderable *Ebullition*.

Now to know, whether the *Aqua-fortis* gave to the *Spirit* of *Wine* ſome new Vigor or Force to make it Bubble; we mixed without the *Recipient* ſome *Aqua-fortis* with *Spirit* of *Wine*; the Quantity of the former being ſomewhat more than that of the latter. This Mixture being put in *Vacuo*, inſtead of Boyling up more ſtrongly than the *Spirit* of *Wine*, (as 'twas thought it would have done, it only caſt up ſome few Bubbles: Which ſhew'd, that the *Ebullition*, which was ſeen when they were Mixed within the *Vacuum*, is of the ſame Nature with all thoſe that are made of *Acids* and *Acalies*. For, in the very inſtant that they are Mixed they make great *Ebullitions*, but ſoon after they Mortifie one another, and loſe the Properties they ad before.

'Tis alſo probable, that the *Aqua-fortis* and the *Spirit* of *Wine* would Boyle always when they are Mingled, but that the Preſſure of the Air keeps this *Ebullition* from being ſenſible, and appears only when that Preſſure is taken off.

When you employ *Rectified Spirit* of *Wine* inſtead of *Aqua-vitæ*, there is required a greater Quantity of *Aqua-fortis* to Mortifie it.

It was alſo Experimented, that the *Solution* of *Common Salt* Boyls alſo with *Spirit* of *Wine*, being Mixed in *Vacuo*; and the *Solution* of *Salt Petre* yet more. The ſame Experiment was alſo made with Common Water, and it's *Ebullition* with *Aqua-vitæ*, purged of Air, was alſo found to be very great, when Mixed in *Vacuo*.

Further, it is ſomewhat remarkable, that *Common Water* doth not Mortifie *Spirit* of *Water*, as *Aqua-fortis* doth, though they make *Ebullitions* with it almoſt of the ſame Degree. The Experiment of it is eaſy: For, making without the *Recipient*, a Mixture of *Common Water* and *Aqua-vitæ*, this, being put within the *Vacuum*, Bubbles up very will, though the *Common Water* be there in greater Quantity than the *Aqua-vitæ*; whereas a Mixture of *Aqua-fortis* and *Aqua-vitæ* did not there Bubble up at all.

After this, the Experimenter being deſirous to ſee whether theſe *Ebullitions* did make *new* Air; he put in the *Recipient* a Gage (that is a Glaſs Tube fill'd either with Water freed of Air, or with *Mercury* ſerving to meaſure the Quantity of the Air in the *Recipient*) which was 4 Inches long, and obſerved, that at the Inſtant when the Liquors were mingled together, the *Water* in the *Gage* roſe very nimbly to the top of the *Gage*; and then drawing out this *new Air* that was made, he made the *Gage-Water* ſubſide again by Degrees, in like manner as when the *Common Air* is drawn out: And by this means, it was ſeen, and all theſe kinds of *Ebullition* made an Air which Expands it ſelf like *Common Air*. Yet it is very remarkable, that the Air which is made by theſe *Ebullitions*, is not of the ſame Nature; For, it hath been found Experimentally, that the Air formed by the *Mixture* of *Aqua-fortis* and *Copper* remains always Air, and always keeps up the *Water* in the *Glaſs* at that Height to which it raiſed it; but on the contrary, that *Air* which hath been produced by the Mixture of *Oyl* of *Tartar*, and *Oyl* of *Vitriol*, is almoſt all deſtroyed of it ſelf in the ſpace of 24 Hours, in ſo much that in the *Recipient*, 24 Hours after the *Ebullition* had been there made, there was not found much more *Air* than there was before the ſame was made.

2. Mr. *Boyle* (as 'tis recorded in the *Journal Book* of the *Royal Society*, *Apr.* 30. 1668. gave an Account to the ſaid *Society* of the Experiments he had then made about *Generating new Air*, or *Extricating* that *Air* which was lurking before in ſeveral Bodies: At which time he mentioned alſo ſome ways of *Examining*, whether the Subſtance thus produced be *True Air* or not.

And long before that time, *viz. An.* 1664. the 15. of *Mar.* (Witneſs the ſame *Journal*) Mr. *Boyle* mentioned to the *R. Society*, that *Corals* or *Oyſter-Shells* pounded, and put into *Diſtill'd Vinegar*, might prove fit Subſtances to produce *Air*, wholeſome for *Inſpiration*. At which time he alſo *propoſed*, that ſome fit Animal might be put into a *Receiver* of his Exhauſting Engine, and the *Air* pump'd out till the Creature grew Sickiſh, and that then ſome *new Air* might be produced in the *Receiver* by a Contrivance of making *Diſtill'd Vinegar* work upon the Subſtances before mentioned; to ſee whether by this means the Animal would recover.

About which time Sir *Chr. Wren* alſo ſuggeſted, to put a *Fermenting* Liquor in a Glaſs Ball, and to fit a *Stop-Cock* to it, and tye a Bladde about the top of the *Stop-Cock*, by which means the *Air*, to be *generated* by the *Fermentino* Liquor, would paſs into the Bladder, and upon the turning of the *Stop-*[illegible]*k* be kept there in the form of *Air*. Mr. *Hook* alſo mentioned ſeveral [illegible]iors, which by their working upon one another would produce an *Air*; [illegible] of *Tartar* and *Vitriol*; *Spirit* of *Wine* and *Turpentine*. And the ſame [illegible]ade before the *R. Society* the following Experiment: He took a Common [illegible]'s Vial with two Pipes, and ſome pounded *Oyſter-Shells* and *Aqua-fortis* [illegible]d as ſoon as the latter was by one of thoſe Pipes poured upon the form[illegible], and the Hole ſtopt with good Cement, the *Ebullition*, cauſed by the

Shells being Corroded by the *Aqua-fortis*, did in a very little time blow up the Bladder, tyed on the other Pipe, ſo as to ſwell it very Plump with *Air*; which Expanſion remained till the *Society* roſe, after they had order'd the ſaid Veſſel to be carefully lock'd up till their next Meeting, which being the Week after, the Bladder was then found ſomewhat ſhrunk. The like Experiment was made with Bottled Ale, ſuppoſed to yield a more wholeſome Air for Reſpiration.

3. One Day we mingled equal parts of *Aqua-fortis* and *Aqua-vitæ*; and having put two equal Quantities of this Mixture in two ſmall Glaſſes with two equal bits of *Iron*, one into each; one of the Glaſſes was included *in Vacuo*. Then there was ſeen a very great *Ebullition*, and the Liquor became *black*, whilſt that which was left without the *Recipient* wrought almoſt nothing, but remained always Tranſparent, and rather White than Black. After theſe two Glaſſes had ſtood thus 12 Hours, that which was *in Vacuo* was taken out, and found that the *Iron* was almoſt all diſſolved, whereas the other was very little diminiſhed. This Experiment ſucceeds quite contrary when 'tis made with *Aqua-fortis* alone and *Copper*; for then the *Diſſolution* is leſs within the *Vacuum*; than without it.

We made ſome other Mixtures of divers Liquors, which make no *Ebullition* at all *in Vacuo*, no more than they do in open Air. *Oyl* of *Olives* makes none neither with *Vinegar*, nor with *Spirit* of *Wine* at the inſtant that they are mingled; neither doth the ſaid *Oyl* mortifie the *Spirit* of *Wine*. Only this we obſerved one Day, that having mingled together, without th *Recipient*, ſome of that *Oyl* and *Vinegar* and *Spirit* of *Wine*, and put this Mixture *in Vacuo*, it did not Boyl up ſo ſoon as when there was no *Oyl*; bu then the Bubbles which it made afterwards were bigger, and they began to appear again from time to time, ſo that ſome of them were ſeen a Qua ter of an Hour after the *Recipient* had been evacuated. Poſſibly this m come to paſs, becauſe that the *Oyl*, ſwimming on the Top, retains the mo Volatile parts of the *Spirit* of *Wine*, which elſe would Fly away as ſoon the Air is begun to be pump'd out, and at the ſame time it hinders the Su face of the Liquor below from eaſily Riſing up into Bubbles, becauſe, t make them do ſo, the parts of the *Oyl*, that ſtick cloſe to one another, mu be ſeparated. When therefore the Volatile parts are gathered togeth in a ſufficient Quantity, able to ſurmount the Reſiſtance which the O makes to it, they iſſue out with much more Violence, than if nothing h retained them.

All theſe *Ebullitions*, hitherto ſpoken of, are greater *in Vacuo* than in th *open Air*: But with *Lime* it is not ſo. For, taking two equal Glaſſes wit two equal Quantities of *Water*, and putting the one of them *in Vacuo*, th other in the free Air, there was let fall into both at the ſame time tw equal parcels of *Lime*; one into each; and it appeared, that that which w *in Vacuo* did indeed throw up ſome big *Bubbles*, but yet fewer of them th that which was in the Air; and having taken it, an Hour after, out of t *Recipient*, and ſtirred the *Lime*, it was found to have only the Conſiſtence *Dirt*, whereas the other had the Conſiſtence of *Slecked Lime*. The Reaſon

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which may perhaps be, that the *Volatile Salts* of the *Lime* do exhale whilſt the *Recipient* is emptying.

There was alſo ſome *Plaiſter* of *Paris* ſlecked *in Vacuo*, and the *Ebullition* of it did there appear much more than it doth in the open Air. When it is not Touched, the Bubbles that iſſue out leave great Holes in it, and then it ſettles very uneven; but taking Care to ſtir it until the *Bubbles* be come forth, and preſſing it when it begins to Settle, it becomes very ſmooth, and hath not ſo many little *Holes* as the *Common Plaiſter*.

I took one Day a ſmall *Recipient*, and inſtead of the *Iron Wire*, I paſſed into the little *Hole* a Sprig of a known Plant, which was *Balm*, ſo as that the *Top* of the Plant was within the *Recipient*, and the *Roots* without. Then I cloſed the reſt of the *Hole* with Cement, and when I had taken away my little *Emptied Receiver*, with the Plant half ſhut up therein; I put the whole into a great Glaſs fill'd with *Water*, the Root being downwards; and I ſaw, that there were formed little *Water Drops* upon the Leaves that were *in Vacuo*. I left it 10 Days in this Condition, and during that time there was entered about *two* Spoonfulls of *Water* into the *Receiver*, and in all appearance this *Water* had preſſed through the Plant. Yet there appeared no more any Drops upon the Leaves; but that might very well come from the groſſer *Excrementitious* Matter that is in the *Water*, which had ſtopp'd the Conduits.

After this, to know whether any Air had been form'd there, I replaced the *Receiver* upon the Engine, and having whelmed a bigger upon it, I ſaw there was but very little Air formed in the ſmall one, becauſe the great *Recipient* was almoſt all Empty before the Air included in the little one could lift it up. Yet at laſt it did Raiſe it, and I enclined the Engine, to the end that the little *Receiver* might not be applyed to its *Cover*, when I ſhould let the Air re-enter; and after this manner both the *Recipients* were filled in the ſame time. Then I looked upon the Leaves of the Plant; They were not withered, though they were not grown; only the Leaves had in the Middle a little changed their Colour, and had a ſmell ſomewhat Souriſh; but the next Morning the Plant was quite Spoiled. We may believe that the Preſſure of the Air had made the *Water* enter into this Plant with ſo great a Violence, that thereby it had, as 'twere, mortified the parts, eſpecially in the Middle where the Leaves were moſt tender; but this Water ſtill kept the Leaves extended, and ſo they withered not; but, when the Air came to act upon them, the parts of the Plant which had ſo much ſuffered were ſoon corrupted by it. For 'tis very probable, as well by this Experiment, as by others hereafter to be mentioned, that the Air is a Diſſolvent which corrupteth Bodies.

This being done, I made the Experiment the other way, that is, with the Leaves in the Air, and the *Roots* in a *Bottle* of *Water* that was *in Vacuo*; and immediately I ſaw Air Bubbles iſſuing out at the End of the Tail *in Vacuo*. After this, I put Water upon the Leaves, to ſee whether this Air came from thence, and I ſaw indeed ſoon after, that theſe Bubbles began to ceaſe; and having taken away the Water wherein the Leaves were, I ſaw that the Bubbles began to iſſue out at the Tail as before : And I ſaw them ſtill come out 24 *Hours* after, but in *little Quantity*; and at length it quite ceaſed. During theſe 24 *Hours* the *Roots* did lengthen about for Lines, that is, one third of an *Inch* which is little leſs than they ordinarily do in the *Air*.

I kept the Plant in this Condition for *four Days* upon the *Engine*, and took care from time to time to draw out the Air that entered into it by the Leaves; and then it began to *wither*, and the *Roots* ſhot no more

Another time I put *two Twiggs* of *Baulm*, each into a Vial full of *Water* and at the end of 5 Days, when I ſaw manifeſtly that they both ſhot *Roots*, I included in the *Vacuum* that of the *two* which had the *longeſt Roots*, without taking it out of its Vial. At the end of *three Days*, obſerving that it was *Wither'd in Vacuo*, I took it out, and changed the Vials of the *Twiggs*, to ſee, whether that which had remained in the Air, and did Thrive very well in *common Water*, would alſo Thrive in *Water freed* of *Air*; and whether that which was *withered in Vacuo* would revive in the *common Water* and in Air. *Four Days* after I found the *Twigg* that had been *in Vacuo* quite ſpoiled and the other ſtill Verdant, but not Thriving; and I obſerved, that it did not begin to ſhoot in the *Water freed* of *Air* till *ten Days* after it had been put in.

This Experiment drew another after it, to know whether the Water purged of Air were leſs fit than common Water to make Plants *Vegetate*. For this end I took *two* Vials full, the one of Water purged, the other of common Water, and having put a *Twigg* of *Baulm* in each, I left them both in the Air. I found, that the *Twigg* in the common Water ſhot at the end of 6 Days, and in Water purged ſhot this Time neither but *ten Days* after it had been put in.

I repeated this Experiment once more, and I was much ſurprized to ſee, that the *Twigg* in the Water freed of Air begun this time to ſhoot the 3d Day, and the other in the common Water, ſtill the 6th Day. But this was remarkable herein, that the *Twigg* in the Water purged ſhot no more but one *Root*, which grew very long, and on the 9th Day only it began a little to ſhoot another, which lengthned but one Line in *two* Days, whereas the *Twigg* in the Common Water had then 9 or 10 *Roots*, which were all very long, having always lengthned *five Lines* or more in a Day.

Although this Experiment appear'd at firſt contrary to the precedent, yet it ſtill confirmed the firſt thought, to wit, that the Air which is mixed in common Water ſerves for *Vegetation*, conſidering the little *Root* which the *Twigg* ſhot in the Water cleanſed of Air.

After this, I made ſome Experiments upon harder Plants. One Day I put a Green piece of *Sallow wood*, part in the Air and part *in Vacuo*, after the manner above deſcrib'd. I put into Water that part which was in the Air, and the Water preſently began to mount and to paſs through the middle of the Wood, and unceſſantly formed *Bubbles* in the *Receiver*. Theſe *Bubbles* continued thus for the Space of 24 *Hours*; and certainly it was the *Water*, which paſſing through the *Wood* was in part changed into *Air*. For, I made the ſame Experiment with a piece of *Buffe*, and the Water mounted alſo and paſſed through it, but it formed no *Bubbles*. Mean time, if there be *Valves* in *Wood*, they muſt needs be unable to reſiſt the *Preſſure* of the *Air*; for I have noted in *Sallow*, as well as in *Elm*, that the Water paſſes thro' them with the ſame Facility what End ſoever you put *in Vacuo*.

One Day alſo I put the *upper end* of a little *Elm branch* in the *Vacuum*, and the *lower end* in the *Air*. This *lower End* I trenched in Water, as I had done the Roots of *Balm* before: But it was a whole Hour before there appeared any *Drop* of *Water* upon the *Elm-leaves in vacuo*, whereas upon the *Balm-leaves* the *Drops* appeared preſently. The Cauſe of which may be the hardneſs of the *Elm-wood*. But I know not, why Water paſſing thro' Wood forms *Bubbles*, and in paſſing thro' Leaves, forms nothing but Drops.

I made alſo the Experiment the other Way, that is, the *Leaves* in the Water without the *Recipient*, and the *lower end* of the Branch *in vacuo*, and I ſaw, that there paſſed nothing for 2 Hours time; inſomuch that I cut a little of the upper end of the Branch which was very tender, and then indeed I ſaw a little Moiſture appear at the end that was *in Vacuo*, but that enough only to form one Drop, and there appear'd no Bubbles of Air. Then I cut the Branch yet a little lower, and then there was formed one Drop of Water at the end that was *in vacuo*, but it fell not. And having cut the Branch yet a little more, the drop of Water fell down *in vacuo*. This ſhews, that they were not the *Valves* of the *Plant* that hindred the Water from paſſing whilſt the Branch was entire; but rather that it was the great Tenderneſs of the Leaves, ſuffering themſelves to be compreſſed by the Preſſure of the Air, and that ſo the Water could not inſinuate it ſelf between their Parts.

Apr. 3. 1673. * I included an *Apple*, which had a little Speck of *Rottenneſs*, and ſome Water in the ſame *Recipient* thereby to promote the *Corruption*, in caſe any ſhould come to paſs: But I have not found that any *Change* happen'd to it ſince that time.

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* *Theſe* Experiments *were* Printed *at* Paris, in the Year 1674.

Jun. 7. I included in a *Receiver* 2 *Noſegays* of *Roſes*, one ſuſpended at the Top, the other having its Tail in a little Veſſel full of Water. I alſo put in the ſame *Receiver* a Gage 4 Inches long, to know whether any Air would be there produced. Two Days after, I found my *Roſes* a little wither'd, and the *Water* already riſen to 8 or 10 *Lines* near the top of my Gage; and after that the Changes of theſe *Flowers* became ſtill leſs, ſo that at this preſent time they are not much more wither'd, and the Water of the Gage is by 3 or 4 Lines nearer the Top. The *Roſes* which lie dipt in the Water are as much withered as the others, and as ſoon. Other *Roſes* which I had included at the ſame time, but with Air, grew mouldy in leſs than 8 Days.

At another time I included one ſingle *Roſe-button*, in a very little Glaſs, to learn whether it would keep its Scent. At the end of 15 days, it looked a little leſs freſh, but was not at all wither'd; and having taken it out, I found it had ſtill its good *Smell*; but after that it loſt all both *Colour* and *Smell* in leſs than 2 Hours. I muſt alſo add, that its Leaves did not appear moiſt in the *Vacuum*, but they looked all moiſt as ſoon as they were in the *Air*, Which ſhews, that the Parts of the Leaves had acted as Springs, like as *Spunges* do, and that the Weight of the *Air* coming to preſs upon them, did expreſs the Humidity which had inſinuated it ſelf between the parts thus expanded.

I did alſo include ſome *Gilly-flowers*, which changed but very little; only they looked as if they had been dipped in Water.

Having included ſome *Strawberries*, at the end of 2 Days they look'd leſs freſh; but after that, ſeeing they changed no more, I took them out of the *Vacuum* after they had been there 15 Days. They had ſtill the Smell and Taſte of *Strawberries*; but they had alſo contracted a very ungrateful Taſte of the Cement which I then employed to cloſe them up with.

Vid. Sup. §. LXXIV. At another time, I put ſome *Strawberries* without Cement, making uſe of a Skin, after the manner deſcribed formerly, and I then obſerv'd nothing new, except that their Taſte kept good, but was a little ſouriſh, and that they yielded a little Water.

Jun. 24. I included ſome *Cherries*, to the Number of 25 or 30, in a *Receiver* which was almoſt fill'd with them. They all burſt but 2. *Two Days* after they had a little chang'd their Colour, and thoſe two that before remained whole, were now burſt like the reſt. After that, I obſerv'd no more Change in them.

Jul. 20. I included in the *Vacuum* one *Cherry*, with eleven great *Currants*. The *Cherry* burſt preſently, and after that, I found it not changed, only it appear'd turned, as the *Currants* alſo did: This is a Beginning of Putrefaction, which may be imputed to the Air that remains in the *Receivers*.

Jul. 27. I included in the *Vacuum* four *Raſberries* and three *Currants*. The latter appear'd alſo to be turn'd, and the *Rasberries* looked leſs freſh than they were. But 'tis now more than 5 *Months* that I perceive no Change in them.

Hitherto I had employ'd none but *ſmall Receivers*, which did juſt hold that little Fruit I put in them, and the *red Currants* ſeem'd to keep well enough; ſo that one Day I fill'd a great Glaſs, of the figure of *Cupping Glaſſes*, with them, hoping to keep that as well as the *ſmall Receivers*. But I was ſurprized five Days after, to ſee that *Bubbles* were formed in the *Turpentine* which I had put about the ſaid *great Glaſs* in the place where 'twas faſten'd to its *Cover*, aud that theſe *Bubbles* were burſt outwards; and afterwards having ſeen that the *Cover* held faſt to the *Bolt-head* no longer, I made no doubt of the *Currants* having produced Air enough to lift up the ſaid great Glaſs, and to form in the *Turpentine* the *Bubbles* I had ſeen. I was confirmed in this Thought, when I found by the *Smell* that they had fermented. They were yet good, except ſome that had loſt almoſt all their Taſte, and all their Acidity.

The ſame thing happen'd to me with a very *ſmall Receiver*, that could hold no more but one *Cherry*, of that kind we call *Bigarreaux*, and one *red Currant*. Theſe Fruits yielded alſo Air enough to lift up their *Receiver* 7 Days after they had been included therein: And having reiterated this *Experiment*, I found the ſame Succeſs; only this ſecond Time the *Receiver* was not lifted up till the 11*th* Day. This Effect is rather to be aſcribed to the *Cherry* than the *Currant*, becauſe I have kept *Currants* to the number of 11, in a ſmall

Glaſs, and they did not raiſe it up. Whence it follows, that the *Bigarreaux* yield much more *Air* than acid Fruit.

Another Time I included ſome of the ſame kind of *Cherries*, a whole great Glaſs full, and found, That from the ſecond Day they had yielded *Air* enough to lift up the *Cover*. I took away part of the *Cherries*, and included the reſt again.

This ſecond Time they did not raiſe the Glaſs till the 8*th* Day. The *Cherries* looked fair, but they had loſt much of their Taſte, and afterwards they were ſpoiled in leſs than an Hour.

I did alſo one Day include three *Pears*, of that ſort we call *Rouſſelets*, in a like-figur'd Glaſs, which could hold no more. They lifted up the Glaſs at the end of 5 Days, and they were not changed, only one of them was a little ſofter.

Another time I put a *Peach* in ſuch a Glaſs emptied of *Air*, with a Gage to it; and I found, that the firſt 6 Hours the *Quickſilver* in the Gage was riſen about an *Inch*. Yet it was not till the 13th Day that the Glaſs was lifted up; and the *Peach* appear'd to have kept very well till then; but after that, it rotted in a very little Time.

I did once put ſome *Bread* with a *Gage*, but I found not that for the ſpace of a whole Month it had yielded any Air, ſo that I took it out, and found it yet good; only it had a little Taſte of *Muſtineſs*, which yet appear'd not at all to the Eye, and whereof the Cauſe may be aſcribed to that little *Air* that might reſt in the *Receiver*.

One Day I included a piece of roaſted Mutton with a Gage, and found, that in 4 Days it had yielded no Air, but after my Abſence of 6 Weeks, I ſaw the *Mercury* was riſen to the middle of the Gage, and having taken out the Meat, I found it of a very ill Smell.

Two Days after, I included a piece of *Raw Beef*, and a *Gage* with it, and I ſaw, that in 2 Days the *Quickſilver* was riſen an *Inch* in the *Gage*; and after 6 Weeks Abſence, I found the *Mercury* was got almoſt to the Top of the *Gage*, and that this Meat had contracted a much worſe Smell than that which had been roaſted.

I alſo kept for 15 Days a piece of *freſh Butter in Vacuo*, and I found, that it ſmelt more ſtrong than when I firſt put it in: But yet it could be ſtill eaten upon Bread, whereas another piece of *Butter*, which at the ſame time I had kept in the Air, was altogether unfit to be eaten

One Day I covered a Receiver, whoſe 4*th* part was fill'd with Water, and the reſt all empty. I put it over the Flame of a *Candle*, and ſaw, that the Water boiled very quickly, yet the Glaſs not much heated; ſo that the *Water* boiled near a quarter of an Hour, with a great *Ebullition*, and the Glaſs was no more than tepid. I then took it away from the Flame, and ſaw that the *water* continued a very great while boyling, and that it began again from time to time. I then believed that the Vapours which had been raiſed into the Air, were recondenſed by the Cold, and that that made the *hot Water* bubble up, as *Water* uſually doth when 'tis put into the *Engine*, and the *Air* tha[illegible]ſſes it exhauſted. Mean Time, I have ſince made the Experiment n.122.p.544.

with a Gage, and I did not perceive, that all the *Bubbles* that iſſued out of the Water, wade the *Mercury* riſe to Senſe.

After this, I left my *Receiver* expoſed to the Froſt, and I found that the *Ice* which was made therein was not yet quite free from *Bubbles*, though the Water thereof had boiled in the *Vacuum*, which one would think, ſhould have driven out all the Air; yet the *Bubbles* were there far leſs numerous than in *Ice* made of ordinary Water. I perceived not that the *Quickſilver* was much riſen in the *Gage*. Afterwards I melted this *Ice*, and put the Water abroad to freeze again, ſtill without taking it out of the *Vacuum*, and I found that this ſecond Time it was very much freer from *Bubbles*. The Glaſs did not break; but becauſe it was ſomewhat conical, we could not know, Whether it remained whole upon the Account of its Figure, or becauſe that the Water which was frozen within was freed of *Air*.

After this, I made *Spirit* of *Wine* boil *in Vacuo*, in the ſame manner I did the Water; and I ſaw that it boil'd much ſooner. It made the *Mercury* riſe about an *Inch* in the Gage. Then I took it from the Fire, and ſaw it continue in its Boiling; and even ſinking the *Receiver* into cold Water, it thereupon boiled much more ſtrongly. One would think this proceeded from an *Antiperiſtaſis*; but we have more ground to ſay, it came from hence, that the Vapours of the Spirit were condenſed and ſo made the *Receiver*, more empty; which is ſufficient to make the Spirit of Wine boil, even tho' it were not hot. The *Quickſilver* did in *two Hours* ſubſide again, to near half a Line as low as it had been. Then I put the *Receiver* over the Flame again, and made the *Mercury* riſe more than *two Inches*; but then the *Receiver* cracked.

One day I took a *Tube* of *Plaiſter* of *Paris*, open at one end, and cloſe at the other. I applied the open End to the Cement as I was wont to do *Receivers*; and I ſaw it was not poſſible thus to exhauſt it, becauſe the *Air* did eaſily paſs thro' the *Plaiſter*. I put therefore a *Tube* of *Iron* on the *Engine*, ſo as having fill'd it with Water, the Tube of *Plaiſter* was covered therewith; and then having cauſed the *Pump* to be plied, I found, that the *Water* did paſs as eaſily thro' the ſaid *Plaiſter*. I therefore covered it with *Venice-Turpentine* inſtead of *Water*, and then I ſaw that it evacuated very well, and that nothing paſs'd thro it for the ſpace of *two Hours*. Then I took ſome Oyl very hot, and poured it over the *Turpentine*, which did melt by this Heat, and paſs'd thro' the *Plaiſter*. Then I took off this Tube, which was ſo pervaded by the *Turpentine*, and I ſaw, that that had made it *tranſparent*: Which Effect is pretty like, and is to be explicated in the ſame manner as that of the little Stone called *Oculus Mundi*. Thus we may be aſſiſted by the Weight of the *Air* to make divers ſorts of *Glues* penetrate *Plaiſter*, *baked Earth*, *Wood*, &c. And poſſibly thoſe, who ſhall make a good number of ſuch Trials, will find their Labour and Pains recompenced, by giving to thoſe Materials ſuch Properties as they never had before.

I did alſo put ſome *Eggs* in the *Vacuum*, and one day, I ſaw one of them break, which I had put in a ſmall *Receiver*. It burſt upon the very firſt *Suction*: But ſince that time I could never make any *break*, tho' I exhauſted as much as

I could thoſe *Receivers* wherein I had put ſome. You muſt therefore begin to crack them a little before you put them in the *Vacuum*, and then they do eaſily break quite, and what is in the Egg riſeth all into a very thick *Froth*: I alſo put ſome of theſe thus ordered over the Fire, where they boiled very eaſily, not being preſſed by the Air, but they boiled there very long, before it began to appear that they were ſo boiled as to be ready to eat.

All the little Bubbles that appear in *Muſtard*, do ſwell and break *in vacuo*, and after that, the *Muſtard* is ſeen to be without Bubbles.

One day I included a *black Ribbon* in the *Vacuum*, and then burnt it with a *Burning Glaſs*. Abundance of Smoke iſſued out of it, which fell by little and little, and ſo permitted us to ſee the *Ribbon* plainly; which appeared not at all changed. But after I had returned the Air into it, and touched it, I found it turn'd to Aſhes.

Another time I cauſed alſo ſome *Gunpowder* to be burnt after the ſame manner; and I was much ſurprized to ſee that it burnt Grain by Grain, none of the Grains kindled, firing thoſe which touched. Another time when the Sun had leſs Force, I could not at all kindle the Powder, but I made it only boil and emit Store of Smoke. I had put a Gage in the ſame *Recipient*, by means whereof I obſerv'd that that Smoke produced no Air; for the *Quickſilver* did not riſe in the Tube. I noted alſo, that this Smoke falling upon the Paſt-board, on which I had put the Powder, appeared yellow, of the Colour of *Brimſtone*. After that, I took out the Powder that remained, being like a Black Maſs, and having put it upon burning Coals, I ſaw it burned as doth *Salt-Petre*, and ſo it appeared, that the Sulphur was almoſt all exhaled. I was willing to reiterate this Experiment, and I then ſaw that the Powder after *boyling*, *fuming*, and being kindled Grain by Grain, (as in the firſt Experiment,) at laſt flaſhes out all at once, when one hath the Patience to hold the Fire to it with a burning Glaſs. And when the Fumes are grown clearer, you may ſee Needles of *Salt Petre* ſticking to the ſides of the *Receiver*.

Another time, I put the Weight of 12 or 15 Grains of *Powder* in a Glaſs, ſhaped like a *Cupping-Glaſs*, capable to hold 14 Ounces of Water, and having put Fire to it, I made the Powder boil and ſmoak as uſually. Afterwards, ſeeing that the Corns began to crack very near one after another; I then took away the burning Concave, for fear all ſhould be kindled together: But it was already too late; for the Corns did continue to crack longer than a ſecond of Time, and at laſt all kindled, tho' there was then nothing left to heat them but the Fire which they had kept within themſelves. The *Receiver* was lifted up above a Foot high without breaking.

Another time I put the Weight of 18 *Grains* of *Powder*, together with a *Gage*, into a *Receiver* holding 7 pound of Water; and I ſaw, that the *Powder* was more difficult to be kindled, than in ſmall *Receivers*. Yet at length it was kindled all together, and made the *Quickſilver* riſe to the height of an *Inch* and a half in the Gage; and I am very well aſſured, that all that Air was not come from without; for that part of the *Receiver*, to which the Cover is applied, had always been under Water.

From what I have been relating, it may be concluded, that there is a 5*th* part of *Air* in *Gunpowder*, ſuppoſing, as other *Experiments* do ſhew, that Air is about a thouſand times lighter than Water. For, in this *Experiment*, the *Mercury* did riſe to the 18th part of the height where the Air commonly ſuſtains it; and conſequently the weight of 18 *Grains* of *Powder* did yield *Air* enough to fill the 18th part of a *Receiver* that contains 7 pound of Water. Now, this 18th part contains 49 *Drams* of *Water*: Wherefore, the *Air*, that takes up an equal ſpace, being a 1000 times lighter, weighs $\frac{1}{1000}$ of 49 *Drachms*, which is more than $3\frac{1}{2}$ *Grains*. It follows therefore, that the Weight of 18 Grains of Powder which I employed in my Experiment, contained more than $3\frac{1}{2}$ of Air, which is about the 5*th* part of 18 Grains.

It may alſo be calculated, how many times this *Air* hath been *compreſſed* in the *Powder*: But this Calculation is more uncertain than the former, becauſe we know not, whether this Air took up more or leſs than the 5*th* part of the ſpace which the Powder poſſeſſed. But yet 'tis certain, that tho' it had even taken up 3 Fourths of the whole Room of the Powder, and that the 14 Grains of the other Matter had taken up no more than the one remaining fourth part, ſtill this Air would have been compreſſed about 3 *hundred* times. To calculate this, I ſuppoſe, that the ſpace of a *Cubick Foot* can hold only 72 Pounds of *Gunpowder*, which do contain more than 14 Pounds of *Air*, by the foregoing *Calculus*; which Quantity of Air is therefore found incloſed in the 3 Fourths of a *Cubick Foot*. Now, this ſpace doth uſually contain but about 6 Drachms of *Air*: Wherefore, to make it hold 14 pounds of Air, which is near 300 times ſix Drachms, it muſt needs be, that that Air be compreſſed near 300 times.

There is reaſon to believe, that this Compreſſion is much greater, becauſe a *Cubick Foot* can hold much more than 72 pounds of *Powder*, and becauſe alſo that the 5*th* part of the *Weight* muſt not in Appearance poſſeſs alone the 3 Fourths, and all the reſt take up no more than one Fourth of the Space poſſeſſed by all the Powder.

I ſhould therefore make no difficulty to believe, that all the Effect of *Gunpowder* comes from the Air which is compreſſed therein, and eſpecially in the *Salt Petre*; for I have not yet obſerved that *Brimſtone* yields *Air*. Poſſibly alſo we may find in time, that all other *Fulminations*, *Ebullitions*, and *Fermentations*, that make ſuch ſurprizing Motions, are nothing elſe but Air compreſſed expanding it ſelf.

One Day I included in the *Vacuum* an Inſect which reſembles a *Beetle*, but N.122.p.542 is a little bigger, and when I perceived it to appear dead, I gave it Air again, and it ſoon after recovered. Then I put it in the *Vacuum* again, and having left it there for an Hour, I readmitted the Air, and found, that then the *Inſect* needed much more time to recover. I included it there the third Time, and having left it there two Days, I gave it Air again, and ſaw it needed about ten Hours before it began to ſtir again; yet it recovered well enough this Time: But having put it in again the fourth Time, and left it there 8 Days, it would never ſtir again.

intending to try the like upon a *Butterfly*, I ſaw, that when I readmitted *Air* to it, that the top of its back, which before was much ſwelled, did fall in more than it ſhould, and the *Inſect* would not recover.

I alſo killed in the *Vacuum* many Animals that breath, as *Birds*, *Mice*, *Rats*, *Rabbets*, *Cats*; and ſome of them I recovered by quickly giving them *Air* again, before the *Engine* was quite exhauſted; but I never ſaw any of them *Revive*, that had been in a perfect *Vacuum*.

M. *Guide* did make frequent *Diſſections* of ſuch Animals as we had thus kill'd, and obſerv'd, amongſt other things, that their *Lungs* fell to the bottom in *Water*. He ſaith, that the *Solidity* or *Cloſeneſs* of the *Lungs* of Animals that have died *in vacuo*, comes from hence. that the *Blood* which is propelled into the *Lungs* by the *Vena Arterioſa*, doth ſo ſtrongly preſs the *Bronchi* of the *Arteria aſpera*, that it expreſſes the *Air* out of them, and glues as 'twere their ſides to one another. But for my part, I do not believe, that the Blood of the *Vena Arterioſa* can thus compreſs thoſe *Bronchi*, becauſe that the ſaid *Blood* is incloſed in its Veſſels, that keep and hinder it from compreſſing others. Yet I am not ignorant, that the things that are included in the *Oeſophagus* do indeed compreſs the *aſpera Arteria*, and that the *aſpera Arteria* by being filled compreſſes alſo the *Oeſophagus*, upon the account of the Situation of theſe two *Conduits*. But it appears not at all, that the ſmalleſt *Ramifications* of thoſe *Bronchi*, and of the *Vena Arterioſa*, are ſituate in the ſame manner; for the *Bronchi* being harder than the *Arterial Vein*, they will compreſs it more eaſily, than be compreſſed by it; and ſo if you ſhould blow them up with Bellows, they would glue the Sides of that Vein together, and hinder the Circulation: which is directly contrary to the Experiment, as M. *Guide* himſelf obſerveth.

It is therefore far more probable, that if the *Lungs* be compreſſed, that Compreſſion be made by the *Pleura*, which may be ſwelled within the *Breaſt* as the Skin is ſwell'd without. But it is not neceſſary that the Lungs be compreſſed *in vacuo* to make them ſubſide in Water, for I have divers times put pieces of Lungs, and whole Lungs in the *vacuum*, and they remained there extreamly ſwell'd; but as ſoon as the Air was again intromitted, they became very flat and red, and ſunk to the bottom in Water. Which ſhews, that 'tis ſufficient for getting the Air out of the Lungs to render them cloſe and red; and I have not been able to produce this Effect but by means of the exhauſting Engine. For I have left Lungs a whole Night between two Plates, with a great Weight upon them, to endeavour to preſs the *Air* out of them, but it would not ſucceed, and thoſe Lungs did ſtill float upon the Water. I have alſo tried to make the Air re-enter into the Lungs after I had render'd them ſolid in the Engine, and that I found very eaſy; for drawing them out from the bottom of the Water, I did blow into the *Aſpera Arteria*; and the Lungs ſwelled again, and reſumed their ordinary Colour, and floated on the Water. And this is that which befalls the Lungs of *Infants* new born.

A Pneumatical Experiment, *by* M. Joh. Chr. Sturmius, Ph. Coll. a. 2. p. 8.

LXXX. *I ſeal'd* up a round Glaſs hermetically, and covered it with a double *Bladder* very carefully, and including it in a large Receiver, I found according to my Expectation, that after about 200 *Exhauſtions* had been made, it broke all in pieces with a very great noiſe.

LXXXI. Papers, *of Leſs General Uſe*, omitted.

n.251.p.144 1. A Liſt of the *French Academicians* at their new Regulation in the Year 1699. by *M. Geoffry*.

n.99.p.6158 2. An Account of ſome of the *Natural Things*, with which the intelligent and inquiſitive Signior *Paulo Boccone*, of *Sicily*, hath lately preſente dthe *R. S.* and enriched their Repoſitory.

n.246.p.393 3. Remarks by Mr. *Ja. Petiver*, on ſome *Animals*, *Plants*, &c. ſent to him from *Maryland*, by the Reverend Mr. *Hugh Jones*.

n.255.p.295 4. A Catalogue of *Shells*, &c. gather'd at the *Iſland* of *Aſcenſion*, by Mr. *Ja. Cunningham*. Chirurgeon, with what Plants he there obſerved ; communicated to Mr. *Ja. Petiver*.

n.246.p.390 n.247.p.461 n.249.p.44. n.250.p.70. 5. An Account of a *China Cabinet*, filled with ſeveral Inſtruments and ſome *Natural Curioſities* of that Country, ſent to the *R Society*, by Mr. *Buckley*, Chief Surgeon at Fort *St. George* ; by *Hans Sloane*, M. D.

n.10.p.167. 6. A *Thermoſcope* and a *Baroſcope*, invented by Mr. *R. Boyle*, deſcribed by Dr. *Wallis*.

n.13.p.218. 7. Dr. *Hook*'s *Wheel Barometer*, deſcrib'd in his *Micrography*, is here ſomething improv'd ; by himſelf.

n.91.p.5168 8. *Experiments* propoſed, to explicate the Reaſon of the *Suſpenſion* of *Mercury* in the *Torricellian Tubes* at an unuſual height ; by Dr. *Wallis*.

n.206.p.998 9. Some *Queries*, concerning the Nature of *Light* and *Diaphanous Bodies* ; by Mr. *Edm. Halley*.

n.79.p.3060 10. *Queries* concerning the different Effects of the *Sun*'s Heat collected by a burning Concave, and that of Fire, upon Gold, *&c.* by P. *Fr. Lana*.

n.66.p.2020 11. An *Experiment* concerning the Progreſs of *Artificial Conglaciation*, and the remarkable Accidents therein obſerved ; by the *Florentine Philoſophers*, and publiſhed in their *Saggi di Naturali Eſperienze*.

n.23.p.424 12. Propoſals to try the Effects of the *Pneumatical Engine*, exhauſted in *Plants*, *Seeds*, *Eggs* of *Silk-worms*, &c. by Mr. R. *Boyle*, and Dr. *Beale*.

LXXXII. Accounts *and* Emendations of *Books*, Omitted.

n.27.p.501. THE Hiſtory of the *Royal Society* of *London*, for the Advancement o *Experimental Philoſophy* ; by *Tho. Sprat*.

n.36.p.715. 2. The Progreſs and Advancement of *Knowledge* ſince the Days of *Ariſtotle*, in an Account of ſome of the moſt remarkable late *Improvements* o uſeful Learning ; by *Joſ. Glanvill. Lond.* 1668, in 8vo.

n.8.p.145. ☞ 3. A Narration of the Eſtabliſhment of the *Lyncei*, an *Italian Academ* and of their *Deſign* and *Statutes*.

n.203.p.886 5. *Diogenes Laertius*, *Græce* & *Latine*, cum commentariis integris Doctoru Virorum, *Amſtel.* 1692.

n.194.p.535 6. *C. Plinii* Hiſtoria Naturalis. *Notwithſtanding the great Care of* R. P Harduin

Harduine, *in this Curious* Edition, yet *He hath paſt over ſeveral* Faults; 3 *of which Mr.* Halley *hath here* Corrected, *viz.*

1. *Lib.* 2 *Cap.* 13. Defectus [*Solis* & *Lunæ*] *Ducentis Viginti Duobus* Menſibus redire in ſuos Orbes certum eſt: *whereas it ought to be* CCXXIII; *at which time that* Period *is* Compleated; *and the* Moon *Returns to the* Sun *and to the ſame* Node *Accurately enough, to her* Apogæum *very near, and within a few* Degrees *to the ſame* Place *of the* Heavens.

2. *Lib.* 11. *Cap.* 37. Jecur maxime Vetuſtatis Patiens Centenis durare Annis *Obſidionum* exempla prodidère; *which Mr.* Halley *conjectures ſhould either be* Hoc *Seniorum* exempla, or Hoc *Sirorum* exempla prodidère.

3. *Lib.* 20. *Cap.* 14. *Inſtead of* Syriation & *Vomicas Vulvæ curavit illa, Mr.* Halley *Reads* Satyriaſin & *Vomicas Vulvæ curavit.*

7. Pinax rerum *Naturalium Britannicarum*, continens *Vegetabilia, Animalia*, & *Foſſilia*, in hac Inſula reperta. Auth. *Chr. Merret.* M. D. n.20.p.364. n.24.p.448.

8. Muſeo Coſpiano anneſſo a quello del famoſo *Uliſſe Aldrovandi*, & donato alla ſua Patria dell' Illuſtriſſimo Signore Ferdinando *Coſpi* Patricio di *Bologna* & Senatore, &c. Deſcrizzione di *Lorenzo Legati Cremoneſe*. In *Bologna* 1678 in *Fol.* n. 140. p. 1015.

9. Muſæi *Petiveriani* Centuria Prima; Rariora Naturæ continens: viz. *Animalia, Foſſilia, Plantas*, ex variis Mundi Plagis advecta; Ordine digeſta; Nominibus propriis ſignata; & Iconibus Ænæis eliganter illuſtrata. *Lond.* 1696. in 8°. n.224.p.393

10. 1. Saggi di Naturali Experienze, fatte nell' *Academia del Cimento*, in *Firenze*; *An.* 1667. in *Fol.* n.33.p.640.

2. Eſſays of Natural Experiments made in the *Academy del Cimento* under the Protection of the moſt Serene Prince *Leopold* of *Tuſcany. Engliſh'd* by the Ingenious *Rich. Waller*, Eſq; *Lond.* 1684. in 4°. n.164.p.797

11. 1. *Miſcellanea Curioſa* Medico Phyſica, *Academiæ Naturæ Curioſorum*, Annus *Primus*, *Lipſiæ* 1670 in 4°. n.68.p.2078

2. Annus *Secundus*; Anni *Scil.* 1671. Jenæ, 1671. in 4°. n.85.p.5024.

3. *Ephemeridum* Medico-Phyſicarum *Germaniæ* Annus *Tertius*, &c. *Lipſiæ* & *Francofurti*. 1673, in 4°. n.101.p.15.

4. Annus IV. & V. Anni 1673 & 1674, &c. Cum Appendice. *Francofurti* & *Lipſiæ* 1676. in 4°. n.129.p.742

12. 1. *Thomæ Bartholini* Acta Medica & Philoſophica *Hafnienſia*. *An.* 1671 & 1672. *Hafniæ*. 1673 in 4°. n.97.p.6138

2. *An.* 1673. *Hafniæ*. 1675. in 4°. n.114.p.318

13. *Georgii Hieronymi Velſchii* Hecatoſteæ 2. Obſervationum *Phyſico-Medicarum* Auguſtæ Vindelicorum. 1675. n.127.p.673

4. *Stephani Chauvini* Lexicon Rationale, ſive Theſaurus. Philoſophicus, &c. *Rotorodami.* 1692. in *Folio.* n.199 p.735

A a

14. 1. Collegium *Experimentale* ſive *Curioſum*, in quo Primaria hujus Seculi inventa & Experimenta *Phyſico-Mathematica*, *A.* 1672. quibuſdam Naturæ Scrutatoribus ſpectanda exhibuit, & ad Cauſas ſuas Naturales demonſtrativa Methodo reduxit, *Jo. Chriſtophorus Sturmius Norimbergæ*, 1676 in 4°. n.121.p.509

2. Pars Secunda. *Altorſi.* 1685. in 4°. n. 175. p. 1184.

15. Ex-

n.93 p.6001 15. Experienze intorno a diverſe *Coſe Naturali*, & particolarmente à quelle che ci ſon portate dall' *Indie*; fatte da *Franceſco Redi* in *Firenze*. 1671. in 4°.

n.207.p.33. 16. *Obſervationi Naturali, ove ſi contengono materie* Medico Fiſiche, *&c.* Natural Obſervations, containing ſeveral *medico-Phyſical*, and *Botanical* matters; with diverſe *Natural Productions*; ſeveral ſorts of *Phoſphori*, *ſubterraneous Fires* in *Italy*; and other Curious Subjects; in Familiar Letters, by Signior *Paul Boccone*. M. D. *Bononia*, 1684 in 12°.

n.207.p.37. n.249.p.53. 17. *Muſeo di* Fiſica, *& di* Eſperienze, *arrichito di Figure di* Piante Nove *Oſſervazione, Note Medicinali e Ragionamenti, ſecondo i Principii di Neoterici, diſpoſito in Decade* VIII. by *S.* Paolo Boccone. Upon this Book Mr. *Ray* adds here ſome Remarks of his own.

n.73.p.2214 18. *Philoſophus Autodidactus*, exhibitus in Epiſtola, ex *Arabica* in *Latinam* Linguam verſa, ab *Edvardo Pocockio*; *Oxon*. 1671. in 4°.

n.69.p.2114 19. *Prodromo* Overo Saggio di alcune Inventioni nouve premeſſo all' *Arte Maeſtra*, di P. *Franciſco Lana S. I.* in *Breſcia*, 1670. in 4°.

n.72.p 2179 20. Of the *Uſefulneſs* of *Experimental Natural Philoſophy*, the 2d *Tome*; by the Honourable *Robert Boyle*, Eſquire, *Oxon*. 1671. in 4°.

n.103.p.53 21. About the Excellency and Grounds of the *Mechanical Hypotheſis*, ſome Conſiderations occaſionally propoſed to a Friend, by *R. B. E. Lond.* 1674. in 4°.

n.181.p.116 22. A Free Enquiry into the Vulgarly receiv'd Notion of *Nature*; by the Hon. *R. Boyle*, Eſq; *Lond.* 1686. in 8°.

n.40.p.810 23. *Ren. des Cartes* Epiſtolæ; Pars *Prima* & *Secunda*. *Lond.* 1668. in 4°.

n.22.p.392 22. Le Tome *Troiſieme* & Dernier des *Lettres* de M. *des Cartes*.

n.54.p.1094 4. Le *Syſtem General* de la *Philoſophie*; per *Francois Bayle*. D. M. a *Tholouze*, 1696. in *Fol.*

n.62 p.2034 25. A Diſcourſe in Vindication of *des Cartes*'s *Syſteme*; by Mr. *des Fourneillis*: To which is annexed, the *Syſtem General* of the ſame *Carteſian* Philoſophy, by *Francis Bayle*, *Lond.* M. D. 1670.

n.70.p.2137 26. *Philoſophia Veterum*, è Mente *Renati des Cartes* breviter digeſta; ab *Antonio le Grand*. *Lond*, 1670. in 12°.

n.80.p.3094 n.108.p.192 27. *Antonii le Grand* inſtitutio *Philoſophia*, ſecundum Principia *Renati de Cartes*, nova Methodo adornata, & explicata, *Lond.* 1672. in 8°.

n.94 p.6046 28. *Antonii le Grand* Hiſtoria *Natura*. *Lond.* 1673. in 8°.

n.123.p.570 29. De Conſenſu *Vet.* & *Nova Philoſophia*, Lib. 4 ſeu Promotæ per *Experimenta Philoſophia* pars *prima*: Auth. *J. B. du Hamel*. P. S. L. in 12°.

n.65 p.2105 30. 1. De *Corporum Affectionibus* cum Manifeſtis tum Occultis Libri 2. ſeu Promotæ per *Experimenta Philoſophia* Specimen Auth. *J. B. du Hamel*, Paris, 1670. in 12°. *Mr.* Boyl'*s Diſcourſe* (*in his* Origine of Forms and Qualities,)

Ibid. p 2106 *concerning the Neceſſity of the* Creator's Concourſe *in the* Preſervation *of all things, being Miſunderſtood by Mr.* du Hamel, *is here* Explain'd.

n.98.p 6151 2. De *Corpore Animato*, Libri 4. ſeu Promotæ per *Experimenta Philoſophia* Specimen alterum: Auth. *Joh. Baptiſta du Hamel*. P. S. L. *Pariſiis*, 1673. 12°.

n.131.p 790 31. Clavis *Philoſophia* Naturalis, *Ariſtotelica Carteſiana*; Editio ſecunda, aucta Opuſculis Philoſophicis varii Argumenti; quibus Errores Scholarum paſſim deteguntur, ac veritas *Philoſophia*, quam *Carteſianam* vocant, confirmatur, Auth. *Jo. de Raei*. *Amſt.* 1677: in 40.

32. Elementa *Phyſica*, ſive nova *Philoſophiæ* Principia; ubi *Carteſianorum* Principiorum Falſitas oſtenditur, ipſiuſque Errores ac Paralogiſmi ad Oculum demonſtrantur ac refutantur; a *Fran. Wilhelmo* Libero Barone de *Nuland*, &c. *Hagæ Comitis*, 1669. in 12°. n.65 p.2037

33. Placita Philoſophica *Guarini*. n.20.p.365.

34. *Phyſica* in Decem Tractatos Diſtributa; Auth. *Honorato Fabri* S. J. *Lugd. Gal.* 1669 in 4°. n 68 p.2c8

35. *Honorati Fabri*, S. J. Tractatus duo; quorum Prior eſt de *Plantis* & de *Generatione Animalium*; Poſterior de *Homine*. n.18.p.325.

36. Traite de *Phyſique* par *Jaques Rohault*, a *Paris* 1671. in 4°. n.70.p 2138

37 Propoſitiones *Hydroſtaticæ* ad Illuſtrand. *Ariſtarchi Samii* Syſtema deſtinatæ, & quædam *Phænomena Naturæ* generalia. Auth. *Franciſco Jeſſop* Arm. *Lond* 1687. in 4°. n.191.p.410.

38. *Caſp Bartholini* Thom. F. Specimen *Philoſophiæ Naturalis*. Accedit de *Fontium*, *Fluviorumque Origine* Diſſertatio Phyſica. *Amſtelodam.* 1697. in 12°. n.237.p.62.

39. *Thomæ Cornelii Conſentini* Progymnaſmata *Phyſica*. n.3 op 576

40. Les Eſſays *Phyſiques* du Siure *de Launay*.

41. *Eraſmi Bartholini* de *Natura* Mirabilibus Quæſtiones Academicæ *Hafniæ*, 1674. in 4°. n.30.p 579.

42. Decameron *Phyſiologicum*: Or Ten Dialogues of *Natural Philoſophy*. To which is added the Proportion of a Streight Line, equal to half the Arch of a *Quadrant*. By Mr. *Hobbs*. n.107.p.159 n.138.p.565

43. Coſmopœia Divina, ſeu *Fabrica Mundi* explicata, per *Lud ov. de Beaufort.* M.D. *Ludg. Batav.* 656. in 12°. n 59.p.1052

44. *Carteſius Moſaizans*; Auth. *Joh. Amerpoel Leowardiæ* 1669. in 12°. Ibid.p.1053

45. The Divine Hiſtory of the *Geneſis* of the *World*, explicated and illuſtrated, *Lond.* 1670. in 4°. n.60.p.1083

46. A Treatiſe of the *Bulk* and *Selvage* of the *World*, &c. by *Nath. Fairfax* M. D. *Lond.* 1673. n.99.p.6179

47. *Telluris Theoria ſacra*. Authore *T. Burnetio*. *Lond.* 1681. in 4°.

48. *Archeologia Philoſophica*, ſive Doctrina Antiqua de *Rerum Originibus*; Libri duo. Auth. *Tho. Burnet*. *Lond.* 1692. Ph.Col 3 p.75 n.201.p.759

49. Conſiderations on a Book Entituled, the *Theory* of the *Earth*: Publiſhed ſome Years ſince by the Learned Dr. *Tho. Burnet*. Written by *Jo. Burnet*, Jun. Gent. n.203.p 888

50. The Wiſdom of God manifeſted in the *Works* of the *Creation*; in 2 Parts. By Mr. *J. Ray*. *Lond.* 1692. in 8°. n.196.p.611

51. Three Phyſico-Theological Diſcourſes, concerning, 1. The *Primitive haos*, and *Creation* of the *World*. 2. The *General Deluge*, its Cauſes and Efts. 3. The *Diſſolution* of the *World*, by Mr. *J. Ray*. *Lond.* 1693. in 8°. Ib. p.615.

52. The Prodromus of a Diſſertation concerning a *Solid* contained in a *lid*, by *Nicolaus Steno*. *Engliſh'd* out of *Latin*. *Lond.* 1671. in 8°. n.72.p.2186

53. An Eſſay toward a *Natural Hiſtory* of the *Earth*, and Terreſtrial Boes, eſpecially *Minerals*: As alſo of the *Sea*, *Rivers* and *Springs*. With an ccount of the *Univerſal Deluge*, and of the Effects it had upon the *Earth*. *J. Woodward*, M. D. *Lond.* 1695. in 8. n.217.p.115

54. La

n.219 p.181 199. 54. La Vana Speculatione diſingannata dal ſenſo : Lettera Riſponſiva circa *i Corpi Marini*, che *Petrificati* ſi travano in varii Luoghi Terreſtri. *Di Agoſtino Scilla* Pittore Academico della *Fucina*, in Napoli, 1670 in 4°. *This Book is here* Abridg'd, *ſome ſhort* Notes *added, and ſome of the* Author's Figures *annexed and explained, by two of the* Fellows *of the* Royal Society.

n.8.p.145. 55. 1. The Origin of *Forms* and *Qualities*, illuſtrated by Conſiderations
n.11.p.191. and Experiments ; by the Hon. *Robert Boyle*, Eſq.

n.66.p.2034 2. The ſame in *Latin*. *Oxon* 1669 in 12°.

n.28.p 512. 56. Free Conſiderations about *Subordinate Forms* ; by the Hon. *Rob. Boyle*.

n.63.p.2057 57. Tracts written by the Hon. *Rob. Boyle*, about the *Coſmical Qualities* of things ; the Temperature of the *Subterraneal* and *Submarine Regions* ; and the *Bottom* of the *Sea* ; together with an Introduction to the Hiſtory of *Particular Qualities*. *Oxon*. 1670. in 8°.

58. Experiments, Notes, &c. about the *Mechanical* Origin of diverſe
n.127.p.669 *Particular Qualities* : Among which is inſerted a Diſcourſe of the Imperfection of the *Chymiſts Doctrine* of *Qualities* ; together with ſome Reflections upon the *Hypotheſis* of *Alcali* and *Acidum*. By the Hon. *Rob. Boyle*, Eſq ; *Lond*. 1675. in 8°.

n.130.p.766 59. *Roberti Boyle* Nobiliſſimi *Angli* & *Soc. Regiæ* digniſſimi *Socii*, Opera Varia *Geneva*. 1677. in 4°. *This Edition and Tranſlation* is here complained of *for ſeveral Reaſons*.

n.53.p.1069 60. Certain *Philoſophical Eſſays*, and other Tracts, by the Hon. *Rob. Boyle*.

n162.p.702 61. Experiments and Conſiderations about the *Poroſity* of *Bodies*, in two Eſſays ; by the Hon. *Robert Boyle*, Eſq ; *Lond*. 1684. in 8°.

62. Several Tracts written by the Hon. *Rob. Boyle*, of the ſtrange Sub-
n.96.p.6101 tility, Efficacy, and determinate Nature of *Effluviums* ; of new Experiments to make the Parts of Fire and Flame Stable and *Ponderable* ; together with ſome Additional Experiments about Arreſting and Weighing of *Igneous Corpuſcles* ; as alſo a Diſcovery of the *Perviouſneſs* of Glaſs to Ponderable parts of Flame, with ſome Reflections on it by way of Corollary.

63. An Eſſay of the great Effects of even *Languid* and *Unheeded Motions*.
n.120.p.982 *Lond*. 1685.

n.1.p.8.n.3. 64. New Obſervations and Experiments in order to an *Experimental*
p.46. *Hiſtory* of *Cold*, by the Hon. *Rob. Boyle*, Eſqr.

n.78.p.3043 65. Diſſertations ſur la Nature du *Froid* & du *Chaud*, par le Sieur *Petit* Avec un Diſcours ſur la Conſtruction & l'Uſage d'un *Cylindre Arithmetique* invente par le meſme Autheur, a *Paris*, 1671.

n.267.p.724 66. Thaumantiadis Thaumaſia, ſub Præſidio Dom *Chr. Sturmii*. *Noriburga*, 1699.

n.42.p.845 67. A *Continuation* of new Experiments Phyſico Mechanical, touching th
Spring and Weight of the Air, and their Effects ; The I. *Part*, &c. by th
Hon. *Rob. Boyle*, F. R. S. *Ox*. 1668. in 4°.

n.50.p.1017 68. *Georgii Sinclarii* Ars Nova & Magna *Gravitatis* & *Levitatis*. *Roterod*
mi. 1669. in 4°.

n.92.p.5199 *Some Complaints and Suggeſtions by that Author, (in his Preface) are here A*
ſwer'd.

69. Demonſtratio

69. Dimoſtratione Fiſico-Matematica Delle ſette Propoſitioni, che pro- n.65 p.2019
meſſe *Donato Roſetti.* in *Firenze* 1668. in 4°.

70. Obſervations touching the *Torricellian Experiment*, and the various So- n.104.p.781
lutions of the ſame, eſpecially touching the *Weight* and *Elaſticity* of the *Air*.
Lond. 1674 in 8°.

71. Tracts written by the Hon. *Rob. Boyle*, of a Diſcovery of the admira- n.67 p.2052
ble *Rarefaction* of the *Air* (even without *Heat*;) New Obſervations about
the *Duration* of the *Spring* of the *Air*; New Experiments touching the *Condenſation* of the *Air* by meer Cold; and its Compreſſion without *Mechanical
Engines*: And the admirably Differing *Extenſion* of the ſame Quantity of
Air Rarefied and *Compreſſed*. *Lond.* 1670. in 4°.

72. Tracts, written by the Hon. *Rob. Boyle*, containing new Experiments n.92.p.5199
touching the Relation betwixt Flame and Air, and about Exploſions: An
Hydroſtatical Diſcourſe, occaſion'd by ſome Objections of Dr. *Hen. More*,
&c. To which is annext an Hydroſtatical Letter, about a way of Weighing
Water in Water: New Experiments of the *Poſitive* or *Relative Levity* of
Bodies under Water; of the *Air's Spring* on Bodies under Water; and about
the differing Preſſure of Heavy *Solids* and *Fluids*. *Lond.* 1672. in 8°.

73. Tracts, conſiſting of Obſervations about the *Saltneſs* of the *Sea*: An n.97.p.6127
Account of a *Statical Hygroſcope* and its Uſes; together with an Appendix
about the Force of the Air's Moiſture: And a Fragment about the *Natural*
and *Preternatural State* of Bodies, by the Hon. *Rob. Boyle* To all which is
premiſed a *Sceptical Dialogue* about the *Poſitive* or *Privative* Nature of Cold:
By a Member of the *R. Society*. *Lond.* 1673. in 8°.

74. Tracts, containing, 1. Suſpicions about ſome Hidden Qualities of the n.110.p.226
Air, with an Appendix touching *Celeſtial Magnets*, and ſome other Particulars. 2. Animadverſions upon Mr. *Hobb's Problemata de Vacuo*. 3. A Diſcourſe of the Cauſe of *Attraction* by *Suction*: By the Hon. *Rob. Boyle*, Eſq;
Lond. 1674. in 8°.

75. A Diſcourſe concerning the Origin and Properties of Wind, *&c.* by n.90.p.51[illegible]
R. Bohun. *Oxon*. 1671. in 8°.

76. Aero-Chalinos, or a Regiſter for the Air, *&c.* by *Nath. Henſhaw*, M.D. n.133.p.834
Lond. 1677. in 12°.

CHAP. II.

Hydrology.

I. TAKE a Globe of Fir or Maple, or other light Wood, as *A*. let it be well ſecured by Varniſh, Pitch, or otherwiſe, from Imbibing Water; then take a piece of Lead, or Stone, *D*, conſiderably Heavier than will ſink the Globe: Let there be a long Wire Staple *B*, in the Ball *A*, and a Springing Wire *C*, with a bended end *F*, and into the ſaid Staple, preſs in with your Fingers the Springing Wire on the bended end: And on it hang the Weight *D*,

To Sound the Depth of the Sea without a Line; by Dr Hook. n. 9. p. 147. n. 24. p. 439.

Fig. 45. *D*, by its Hook *E*, and ſo let Globe and all ſink gently into the Water, in the poſture repreſented in the *Figure*, to the bottom, where the Weight *D*, touching firſt is thereby ſtopt; but the Ball, being by the Impetus it acquired in Deſcended carried downwards a little after the Weight is ſtopt, ſuffers the ſpringing Wire to fly back, and thereby ſets it ſelf at Liberty to Re-aſcend. And by obſerving the time of the Balls ſtay under Water which may be done by a Watch, having, Minutes and 2*ds*; or by a good Minute Glaſs; or beſt of all by a Pendulum, Vibrating ſeconds; the which muſt be three Foot, three Inches, and one fifth of an inch long, *viz*: between the middle of the Bullet, and the upper end of the Thread, where it is faſtened, or held when it Vibrates,) You may, with the help of ſome Tables, come to know any *Depth* of the *Sea*.

Note, That care muſt be had of proportioning the Weight and Shape of the Lead, to the Bulk, Weight, and Figure, of the Globe, after ſuch a manner, as upon Experience ſhall be found moſt convenient.

In ſome of the Trials already made with this *Inſtrument*, the Globe being of Maple-wood, well covered with Pitch, to hinder ſoaking in, was $5\frac{11}{12}$ Inches in Diameter, and Weighed $2\frac{1}{4}$ *pounds*; the Lead, of $4\frac{1}{2}$ *pounds Weight*, was of a *Conical*, (but is now uſed of a *Globous*) Figure 11 *Inches* long. with the ſharper end downwards, $1\frac{2}{12}$ at the bottom in Diameter. And in thoſe Experiments made in the *Thames*, in the Depth of 19 foot Water, there paſſed between the Immerſion and Emerſion of the Globe, 6 *Seconds* of an hour; and in the Depth of 10 *Foot* Water, there paſſed $3\frac{1}{2}$ Seconds or thereabouts.

In the ſame Tryals it was alſo found, that there was no difference in time, between the Submerſions of the Ball as the greateſt Depth, when it roſe two Wherry's length from the place where it was let fall, being carried by the Current of the Tide, and when it roſe only a Yard, or ſo, from the ſame place where it was let down: And that it muſt be ſo in great Depths and Stronger Currents, is as certain, as eaſy to be Demonſtrated.

And if it be alledged, that it muſt be known, when a Light Body Aſcends from the bottom of the Water to the Top, in what proportion of Time it Riſes; it may be conſidered, that in this Experiment the Times of the Deſcent and Aſcent are both taken and computed together; ſo that, for this purpoſe, their needs not the nicety which is alledged.

Of other Experiments of this way of *Sounding* without a *Line*, made by the Noble Load Viſcount *Brounker*, Sir *Robert Moray* Knight, and Mr. *Hook*, in the Channel at *Sheerneſs*; the following Account was given; *vid.*

	Ounce.	*Grains*
A Wooden Ball *A* Weighed	$32\frac{9}{18}$	00
Another Wooden Ball *B*,	30	22
A Lead *A*	30	00
Another Lead *B*,	$30\frac{3}{4}$	00

The Ball *B*, and the Lead *B*, were let down at 16 Fathom; and the Ball returned in 48 ſingle ſtroaks of a *Pendulum*, held in the Hand, *Vibrating* 58 ſingle ſtroaks in a Minute.

A Second time repeated with the ſame ſucceſs; therefore the Motion was 4 Foot every ſecond.

Again, the Ball *A*, and the Lead *B*, whoſe Nail was bended into a ſharper Angle; the Ball returned in 39 ſtroaks. A ſecond time repeated with the ſame ſucceſs at the ſame depth.

Ball *B*, Lead *B*, in which Tryal the Line, not being clear, ſtopped a little the Motion; the Ball returned in 47 at the ſame depth.

Ball *A*, Lead *A*, at 8 Fathom and 1 Foot, returned at 20; repeated at 8 Fathom, returned at 19.

Tried the *third* Time at 10 Fathom and 4 Foot, returned at 28.

A *fourth* Tryal, at the ſame depth, juſt the ſame.

At a *fifth*, at 10 Fathom 5 Foot, returned at 27.

A *ſixth* Tryal juſt the ſame.

A *ſeventh* at 12 Fathom 5 Foot, returned in 37.

An *eighth* Tryal juſt the ſame.

Another Day near the ſame place.

Note, That the *Pendulum* was this Day adjuſted, and made a little ſhorter there having been but 58 *Vibrations* in a Minute the other Day.

Ball *A*, Lead *B*, at 14 Fathom, returned in 32½.

A Second Tryal, a little after, in the ſame place, returned in 33. In the making of which Tryal, the *Vibrations* were told aloud, and the Lead having been let down by a Line, was found to touch the bottom in juſt half the time the Ball ſtaid under Water. By a ſecond Tryal, the Aſcending and Deſcending was found to be in equal Times. And by a Third Tryal, with another Lead, the very ſame found, *vid.* 16½ deſcending, and 16½ aſcending. This Lead and Ball let down without a Line, the Ball returned in 13 *Vibrations*; a Sign it went not to the bottom.

A Tryal made with a Lead, whoſe Iron Crook was faſtned at the top of it, *Fig.* 46. ſucceeded very well, and the Ball returned in 34½: But by reaſon of the Current, the Experimenters could not perceive, when the Lead touched the bottom. This Lead being let down without a Line, the Ball returned in 32½ The depth of Water was now found by the Ships Lead, to be 14 *Fathom*.

Another Tryal was made with a Line, bowing the Point of the Lead, and the Ball returned in 34. The ſame let down without a Line, the Ball *Fig.* 47. returned in 6 or 7 *Vibrations*; a Sign again it went not to the bottom. In a Tryal with another Lead, the Ball returned in 34. Repeated again with the ſame ſucceſs.

In a Tryal with a Lead, whoſe Nail was ſet awry, the Ball returned in *Fig.* 48. 34. After which Tryal the Depth was found to be juſt 14 Fathom. The laſt Lead and Ball being let drawn without a Line, the Ball returned at 35. In another Tryal with a Lead that never failed, the Ball returned in 34, and the Lead touch'd the Bottom at 17.

By a Tryal with another Lead, the ſame Time was found exactly.

By a 3d Tryal with this laſt, the very ſame.

Theſe Tryals were made near about High-Water, at the depth of *14 Fathom* juſt, by Meaſure; and in them, the Motions ſeem to be 5 *Foot* every *Second*.

In all theſe Tryals, the greateſt difficulty was, in the uſe of Conical Figures, with Iron Crooks, to bend the Iron that it might be ſure to carry down the Ball with it to the bottom, and when come thither, to let it go: For almoſt every one of theſe Leads failed in one of theſe requiſites, till by ſeveral Tryals they had been adjuſted.

It is not to be Omitted, That the laſt Tryals being made near High-Water, the Ball was found to riſe (by the Boat being permitted to drive) far off upon one ſide, out of the way, That any light thing, ſuffered to ſwim on the Water, wou'd be carried; which ſeemed to argue a motion of the Under-parts of the Water, differing from that of the Upper (a thing which is ſaid to be at certain Times of the Tides, both at the Mouth of the *Sound*, and of the *Streights*; which deſerves to be further enquired into.) The Angle made by theſe different motions, ſeemed to be about 40 *gr.*

To fetch up Water from any Depth; *By Dr.*Hook. n. 9. p. 149. n. 24 p. 447. *Fig.* 49.

II. Let there be made a Square Wooden Bucket *C*, whoſe Bottoms *E E*, are ſo contriv'd, that as the Weight *A* ſinks the Iron *B*, to which the Bucket *C*; is faſtened by two Handles *D D*, on the end of which are the moveable Bottoms, or Valves *EE*, and thereby draws down the Bucket; the reſiſtance of the Water keeps up the Bucket in the Poſture *C*, whereby the Water hath, all the while it is deſcending, a clear paſſage through; whereas, as ſoon as the Bucket is pulled upwards by the Line *F*, the reſiſtance of the Water to that Motion, beats the Bucket downward, and keeps it in the poſture *G*, whereby the included Water is kept from getting out, and the Ambient Water kept from getting in.

By the advantage of this Veſſel; you may come to know the Conſtitution of the Sea-Water in ſeveral Depths; and whether it be Salter at and towards the *Bottom*, than at or near the *Top*: Likewiſe whether in ſome places of the Sea, any ſweet Water is to be found at the *Bottom*.

Directions for obſerving Tides; By Sir Rob. Moray. n. 17. p. 298.

III. 1. To obſerve in what Proportion the Increaſes of the Tides from the Neap to the Spring Tides, and their Decreaſes, and the Riſings and Fallings of the Ebbs, happen to be in regard of one another. It is ſuppoſed upon ſome Obſervations, made by Sir *Sob. Moray* (though not throughly and exactly performed,) that theſe Increaſes are in the Proportion of Sines; the firſt Increaſe exceeding to the loweſt in a ſmall proportion; the next in a greater; the *3d* greater than that; and ſo on to the midmoſt, whereof the Exceſs is greateſt, diminiſhing again from that, to the higheſt Spring Tide; ſo as the proportions before and after the Middle, do greatly anſwer to one another, or ſeem to do ſo.

2. To obſerve, the Increaſe and Decreaſe of the *Velocity* of the *Current*; which is alſo ſuppoſed to be according to the Proportion of Sines.

3. The exact meaſures of the heights of every utmoſt High-water and Low Water from one Spring-Tide to another.

4. The exact Heights of Spring-Tides and Spring-Ebbs.

In order to all which this following *Apparatus* is propoſed to be made uſe of. In ſome convenient place upon a Wall, Rock or Bridge, *&c.* Let there be an *Obſervatory* ſtanding as near as may be to the Brink of the Sea, or upon ſome Wall; and if it cannot be well placed juſt where the low Water is, there may be a Channel cut from the *Low-water* to the *Bottom* of the *Wall, Rock* &c. The *Obſervatory* is to be raiſed above the *High Water* 18 or 20 *Foot*, and a Pump of any reaſonable Dimenſion, placed perpendicularly by the Wall, reaching above the *High-water* as high as conveniently may be. Upon the Top of the Pump a Pulley is to be faſtned, for letting down into the Pump a piece of floating Wood, which as the Water comes in may riſe and fall with it. And becauſe the riſing and falling of the *Water* amounts to 60 or 70 Foot, the *Counterpoiſe* of the *Weight* that goes into the Pump, is to hang upon as many Pulleys as may ſerve to make it riſe and fall within the ſpace by which the *Height* of the Pump exceeds the *Height* of the *Water* And becauſe by this means the *Counterpoiſe* will riſe and fall ſlower, and conſequently by leſs Proportions than the *Weight* it ſelf, the firſt Pulley may have upon it a Wheel or two, to turn *Indexes* at any Proportions required, ſo as to give the *minute Parts* of the *Motion*, and Degrees of Riſings and Fallings. And becauſe if the Hole, by which the *Water* is let into the *Pump* be as large as the Bore of the *Pump* it ſelf, the *weight* that is raiſed by the *Water*, will riſe and fall with an *Undulation* according to the *Inequality* of the Seas ſurface. 'Twill therefore be fit, that the Hole, by which the *Water* enters, be leſs than half as big as the Bore of the Pump; any inconvenience that may fall thereupon, as to the *Periods* and *Stations* of the Flood and Ebb, not being conſiderable.

5 To obſerve the Poſition and Strength of the Wind, the State of the *Weather*; The *Heights* of the *Barometer*, *Thermometer*, *Hygroſcope*, and the *Moon's Age* and *Place* in all Reſpects.

IV. 1. The true Time of the *Tides* at all Times of the *Moon*, is very rudely and ſlightly reckoned up by moſt *Seamen* and *Aſtronomers*, moſt of them reckoning, as if the *Moon* being upon ſuch a *ſet Point* of the *Compaſs* (as the Seaman calls it) or ſo many hours paſt the *Meridian* (as the *Almanack-makers* reckon) it were *High-Tide* in ſuch and ſuch a *Port* at all Times of the *Moon*. And thus they reckon the *Tides* every Day to differ conſtantly 48 *min.* As for inſtance, a *South-weſt Moon* makes a full Tide at *London*, that muſt be underſtood that it is *High Tide* at *London*, when the Moon is 3 Hours paſt the *Meridian*. Now this is true indeed at the *New* and *Full Moon*, but not at other Times of the *Moon*, which few take any Notice of: Only Mr. *Booker* had wont to give this *Caveat*, that about the firſt and laſt *Quarters* of the *Moon*, the *Neap Tides* did not flow ſo long as the *Spring Tides* by one *Point* of the *Compaſs*; but he gives no Rule to proportion the Difference.

Tides *obſerved at* London, *by* Mr. Hen. Philips, n.34. p.556.

But obſerving this more narrowly, I find, that at *London* the Tides fall out at the leaſt *Two Points*, that is, an Hour and a half ſooner, in the *Quarters* than in the *New* and *Full Moon*. I have alſo found by many Trials, that the true Time of the Tides might be found out to be ſomewhat ſhorter and ſhorter, from the *New* and *Full Moon* unto the *Quarters*, yet not in an equal manner, neither gradually decreaſing from the *New* and *Full Moon* until the *Quarters*; but rather, that there was ſome little Difference of Alteration both at the *New* and *Full Moons*, and alſo at the *Quarters*, and that the greateſt Difference fell out in the midſt between them, agreeing very well to a *Circular Proportion* after this Manner.

Fig. 50. 1. Divide a Circle into 12 equal Parts or Hours, according to the Moon's Motion, or Diſtance from the Sun from the *New Moon* to the *Full*.

2. Let the *Diameter* of the Circle be divided inte 90 parts or min. That is, according to the Time of the Difference of Tides between the New or Full *Moon*, and the *Quarters*, which is one Hour and an half.

3. Make perpendicular Lines croſs the *Diameter* of the Circle from hour to hour.

4. Reckon the Time of the Moon's coming to the South in the Circumference of the Circle, and obſerve the perpendicular Line that falls from that point upon the *Diameter*; and the proportional Min. cut thereby, will ſhew how many Hours or Min. are to be ſubſtracted from the Time of high Tides at the *New* and *Full Moon*, that ſo you may have the true Time of the Tides that preſent Day.

For *Example*, At *London*, on the Day of *New* and *Full Moon*, it is high Tide at 3 of the Clock, that is, when the Moon is 3 Hours paſt the Meridian, and ſo by the common Rule, the Moon being about 4 Days old, it will be S. about 3 of the Clock, and it will be high Tide 3 Hours afterwards, that is, at 6 of the Clock. But now by this Rule, if you count this Time of the Moon's coming to the South in the Circumference, the perpendicular Line which comes from 3 to 9, cuts the *Diameter* at 45 Min. which ſhews, that ſo much is to be abated from the Time of High Tide in the *New* and *Full Moons*; ſo that it is high Tide 45 min. before 6 of the Clock; that is, at 5 Hours 45 min. and not at 6 of the Clock, according to the common Rule.

The like you may do for any other *Port* or *Place*, knowing the Time of *High Water* at the New and Full Moon in that place: And you may do it the more readily, if you ſet down the Time of *High Water* at the New an Full Moon under the *Diameter*, as I have done for *London*, where it is hig Tide at 3 of the Clock: So that when the Moon is South at 3 of the Clo the Perpendicular cuts the Diameter at 2 Hours 15 m. and ſo when th Moon is South at 9 of the Clock, by adding Two Hours 15 Min. you m have the Time of *High Water*, which is 11 of the Clock and 5 Min.

And thus you may eaſily make a Table, which by the Southing of th Moon ſhall readily tell you the Time of high Tide at any Time of th Moon, as I have done here for *London*: to which all other places may be reduced to correſpond.

Moon

Moon South.		Tide London		Moon South.		Tide Lond.		Moon South		Tide London		Moon South.		Tide London.	
H.	M.	H.	M.	H.	M.	H.	M.	H.	M	H.	M	H.	M.	H.	M
XII	0	3	0	III.	0	5	15	VI.	0	7	30	IX.	0	11	15
	10	3	9		10	5	21		10	7	4		10	11	29
	20	3	18		20	5	27		20	7	52		20	11	43
	30	3	27		30	5	33		30	8	4		30	11	57
	40	3	36		40	5	40		40	8	1		40	12	10
	50	3	40		50	5	46		50	8	25		50	12	24
I.	0	3	54	IV.	0	5	52	VII.	0	8	36	X.	0	10	37
	10	4	2		10	5	59		10	8	48		10	12	50
	20	4	9		20	6	6		20	9	0		20	1	3
	30	4	16		30	6	13		30	9	13		20	1	16
	40	4	23		40	6	20		40	9	26		40	1	29
	50	4	30		50	6	28		50	9	39		50	1	42
II.	0	4	37	V.	0	6	36	VIII.	0	9	53	XI	0	1	54
	10	4	44		10	6	44		10	10	6		10	2	3
	20	4	50		20	6	53		20	10	20		20	2	16
	30	4	57		30	7	2		30	10	33		30	2	27
	40	5	3		40	7	11		40	10	47		40	2	38
	50	5	9		50	7	20		50	11	01		50	2	49

Theſe things I have found to fall out right at *London* for many Years, and ſo I ſuppoſe they may in other places, if the Difference be not ſo much between the *Neap-tides* and *Spring tides* in other places, the Diameter muſt be divided into fewer parts.

By Mr. Flamſtead, n. 143. p. 12.

2. Having taken Notice that the Tides ſeldom hold out ſo long as Mr. *Philip's* Calculation give them, I obſerved them my ſelf more diligently, and with the help of my Friends and Servants, I noted the times of above 80 high Waters at *Tower Wharfe* and *Greenwich*, whereby I found that the greateſt and leaſt differences betwixt the Moon's true Southing and the high Waters, were not, as Mr. *Philips* had placed them, at the Full or New and Quarter Moon's, but the greateſt nearer to the *Neaps*, the leaſt to the higheſt Spring-tides. I found alſo, that the Inequality was not the ſame that he had made it, and after a Trial or two, that I could repreſent and anſwer above 60 of theſe Obſervations with leſs than one Quarter of an Hour's difference; which, conſidering how difficult it is to determine the time of an high-Water exactly, I cannot but eſteem a very good Agreement.

At Dublin, by Mr. W. Molineux, n. 184. p. 191.

3. At the Bar of *Dublin*, on the New and Full Moons, a *S. S. E.* Moon makes high Water, that is, at half an Hour paſt Ten.

At *Rings-End*, at 3 Quarters after 10.

At the *Cuſtom-houſe* at *Dublin*, at 11.

On the Quarter Days.

High-water on the *Bar*, at 5 a Clock.

At *Rings-End*, at a *Quarter* paſt 5.

At the *Cuſtom-houſe*, half an Hour paſt 5,

A *Southerly Wind* between S. S. E. and S. S. W. blowing freſh, makes it flow near half an Hour longer than its uſual Courſe.

N. B. That this Obſervation makes the Tides, upon the *Quarter-Moons*, come in later, in reſpect of the *Moon's Southing*, than upon *New* and *Full Moons* by half an hour; whereas in the River of *Thames*, as high as *London*, the *Quarter-Moons* make *High Water* above an Hour and Quarter ſooner, in that Reſpect, than the *New* and *Full*; as may be ſeen in the accurate Tide-Tables of Mr. *Flamſtead*; but it is from hence evident, that the ſame Tables are not applicable to the *Sea-ports* (where there is not the ſame Reaſon for the Anticipation of the *Neap-Tides* upon the *Quarter-Moons*.

The Cauſe of this *Phænomenon* ſeems to be, that the *Impulſe* of the Ocean in the *Quarter Moons* is not ſo vigorous as in the *New* and *Full*, nor the Motion of the Waters ſo quick, (as is evident by daily Experience:) Whence it comes to paſs, that in the open Sea, and in Ports upon the Sea-Coaſt, as this of *Dublin*, the High-water Time falls out later than when the Motion is more rapid in the *New* and *Full*; but on the contrary, in Rivers, at any conſiderable diſtance from the Sea, the Reſiſtance of the Weight of the freſh Water, which is kept ſuſpended during the time of the Flood, is longer overcome by the more potent *Impetus* in the *New* and *Full*, than by the weaker in the *Quadratures*; and from hence this Difference ſhould be ſtill more and more conſiderable, as the Port is further removed from the Sea.

Nigh Plimouth, by Mr. Sam. Colepreſs, n. 38. p. 632.

4. Our *Diurnal Tides* from about the latter End of *March*, till the latter end of *September*, are about a Foot higher (perpendicular, which is always to be underſtood) in the Evening than in the Morning, that is, in every Tide that happens after 12 in the Day, before 12 at Night. On the contrary, the Morning Tides from *Michaelmas* till our *Lady-Day* in *March* again, are conſtantly higher by about a Foot, than thoſe that happen in the Evening. And this Proportion holds in both after the gradual Increaſe of the Tides Riſing from the *Neap* to the higheſt *Spring*; and the like Decreaſe of its height till *Neap* again is deducted.

The higheſt *menſtrual Spring Tide* is always the *Third Tide* after the *Ne* *Full Moon*, if a croſs Wind do not keep the Water out, as the *N. E.* or *N.* uſually doth; whoſe contrary Wind, if ſtrong, commonly make thoſe ſo High Tides upon our Southern Coaſts, which otherwiſe would be but lo

The higheſt *Springs* make the loweſt *Ebbs*, (Tho' I am informed by an e pert *Water-man*, that it ſometimes happens, that there may be a very lo *Ebb*, tho' no high Spring which they term an *Out-let*, or *Gurges* of the Se as when a great Storm chances off at Sea, and not on the Land.)

The Water neither flows nor ebbs alike in reſpect of equal Degrees; bu its *Velocity* increaſeth with the *Tide* till juſt at *Mid-water*, that is, *half flo* or at half Flood, at which time the *Velocity* is ſtrongeſt; and ſo decreaſet

pro

proportionably 'till High-Water, or Full Sea. As may be gueſſed at by the following Scheme, collected by Obſervations made at ſeveral Times and Places. And although it be reſtrain'd to *Plymouth Haven*, or the like, where the Water Riſeth about 16 *Foot* (I ſay uſually, becauſe it may vary in this Port from the *loweſt Neap* to the *Higheſt Annual Spring* above 7 or 8 *Foot*) yet it may indifferently ſerve for other Places, where it may Riſe as many Fathom, or not ſo High, by a proportional Addition or Subſtraction.

	Time.		*Height*	
	h	'	*f.*	*inch.*
Flowing	1	0	1	6
	2	0	2	6
	3	0	4	0
	4	0	4	0
	5	0	2	6
	6	0	1	6

	Time.		*Height*	
	h	'	*f.*	*inch.*
Ebbing	1	0	1	6
	2	0	2	6
	3	0	4	0
	4	0	4	0
	5	0	2	6
	6	0	1	6

The uſual Number of Tides, or Times of High-Water from New Moon to New Moon, or from Full Moon to Full Moon, is 59.

In Hong-road, 4 *Miles from* Briſtol, *By Cap.* Sam. Sturmy, n. 41. p. 813.

§. 1. I have obſerved, That our Annual Spring Tides do happen in *March* and *September*, either at the Tide next before the *Sun's* Ingreſs into the *Æquinoctial* Points of *Aries* and *Libra*, or the next Tide after, according as the Moon is near her Full or Change, when the Sun thus enters into the ſaid Signs: And then it flows in height about 45 Foot; the loweſt Neap Tides flowing in height 25 Foot.

Signs.

2. That the Loweſt Neap makes the higheſt Spring, if the *N. E* Winds hinder not, by blowing hard, and ſo keep back the Tides; as uſually they do when they blow: Whoſe contrary Winds, *S. W.* if they blow hard, make here the Higheſt Tides.

3. That from about the latter end of *September*, they are about 1 Foot and 3 Inches higher, perpendicularly in the Evening than in the Morning; that is, if High Water happen after the Sun is paſt the *Meridiam* or in the Tides betwixt Noon and Midnight. But from *Michaelmas* to our *Lady-day*, we find the contrary, the Day-Tides being, in that Seaſon, higher by 15 Inches than the Night-Tides, or the Tides between Midnight and Noon. And this proportion holds in both, after the Gradual Increaſe of the Tides riſing from the Neap to the higheſt Spring, and the like Decreaſe of their Height till Neap again.

4. That the Higheſt Menſtrual Spring-Tide is always the third after the Full Moon or Change day, if it be not kept back by *N. E.* Winds.

5. That it *flows* here on the Change-day, when the Moon is *E. S. E*, the Tide flowing in for the ſpace of 5 Hours, and Ebbing 7 Hours. But in Neap-Tides it does not flow here by two Points of the Compaſs ſo long.

6. That the Water Flows nor Ebbs equal Spaces in equal Times, but its Velocity is ſtrongeſt at the firſt, both of the Flood and Ebb, and ſo gradually Decreaſeth until Full Sea, or Low Water. This is obſerved in Spring Tides only, as you may ſee by the following Table, which I have made for my Obſervations of our Tides here. And I have farther obſerved, that it hath Flow'd or Ebbed at the firſt of the Tide one Foot in 6 Minutes, or that then the Tide Ran out a Foot in 6 Minutes, or did Riſe ſo much in Height.

	Time.		*Height.*	
	h	'	*f.*	*inch.*
Flowing.	0	15	2	7½
	0	30	2	6
	0	45	2	6
	1	00	2	6
	0	15	2	6
	0	30	2	5½
	0	45	2	5
	2	00	2	5
	0	15	2	3
	0	30	2	3
	0	45	2	3
	3	00	2	3
	0	15	2	2
	0	30	2	1
	0	45	2	1
	4	00	2	1
	0	15	1	9
	0	30	1	8
	0	45	1	8
	5	00	1	8
	5	0	44	1

	Time.		*Height.*	
	h	'	*f.*	*inch.*
Ebbing.	0	15	2	7½
	0	30	2	6
	0	45	2	6
	1	00	2	6
	2	00	9	0
	3	00	8	0
	4	00	6	9
	5	30	5	0
	6	00	4	0
	7	00	3	0
	7	00	44	10½

7. The Uſual Number of Tides from New Moon to New Moon, or fr Full to Full, is 59.

8. In the River of *Severn*, 20 Miles above *Briſtol* near *Newnham*, 160 Mi from the River's mouth (*Lundy*) the *Head* of the Flood at its coming in Spring Tides, ariſeth in height like a Wall near 9 Foot high, and ſo runs many Miles together, covering at once all the Shoals which were dry fore; at which time all *Veſſels*, that lie in the way of the ſaid *Head Tides* (as it is vulgarly called) *Boar*, are commonly Overſet, or carried upon *Banks*, and the *Head* of the *Tide* being paſt, ſuch *Veſſels* are left dry again. Flows there but two *Hours* and 18 *Foot* in height, and it *Ebbs* ten *Hours.* Reaſon of the ſaid *Boar* is doubtleſs the ſtraightning and ſhoaling of the R

in that Place, it being there but half a Mile broad; as it is but 20 Pearches over, three Miles higher; running tapering to *Gloceſter*.

6. We have been informed by a curious Gentleman, that the *Annual higheſt Tides* about *Chepſtow* Bridge, were at St. *David's* and *Michaelmas* Stream; that is the one a little before the *Vernal*, and the other ſomewhat after the *Autumnal Equinox*, which agrees alſo with the conjecture of a very intelligent *Mathematician*, who is withal of Opinion, that becauſe both are not far from the *Equinoxes*, tho' the one before, the other after, it might well give Occaſion to think it was depending on the *Æquinox*.

At Chepſtow, by ib. p. 816.

7. Our great *Bay* Mr. *Camden* calls *Waſhes*, whereas they are only Two ſmall Arms of the Sea, running into it, *viz.* *Foſdike* and *Croſs-keys*; 'tis full of Sands, making Two Channels to *Lynn*, and as many to *Boſton*. It may be uſeful to Travellers to have a Table when to paſs over the ſaid *Waſhes*, tho' without a Guide, I would not adviſe them, eſpecially after great Freſhes, which make the Sands ſhift, and conſequently quick, and Horſes many times ſtick faſt, the Way to get them out is, by ſeveral Peoples trampling round them at a Diſtance, which by Degrees raiſeth them.

A Table of the Waſhes *in* Lincolnſhire, by *Mr.* Chr. Merrit, n. 223. p. 352. n. 224. p. 394.

Moon's Age.		*Foſdike begins.*		*Ends.*		*Full Sea*		*Moon's Age*		*Foſdike begins*		*Ends.*		*Full Sea*	
		h.	'	h	'	h	'								
1	16	10	0	4	45	7	0	9	24	4	24	11	09	1	24
2	17	10	48	5	33	7	48	10	25	5	12	11	57	2	12
3	18	11	36	6	21	8	36	11	26	6	0	12	45	3	00
4	19	12	24	7	9	9	24	12	27	6	48	1	33	3	48
5	20	1	12	7	57	10	12	13	28	7	36	2	21	4	36
6	21	2	0	8	45	11	0	14	29	9	24	3	9	5	24
7	22	2	48	9	33	11	48	15	30	9	12	3	57	6	12
8	23	3	36	10	21	12	36								

Croſs-keys, begins to be fordable fifteen Minutes after *Foſdike*, and ends an Hour ſooner.

8. It is high Water upon the Day of the *New* and *Full-moon*,

The Tides in France, by . . . n. 185. p. 820.

On the Coaſt of *Gaſcony* and *Guienne*.

At 3 *h*. At the Mouth of *Garonne*, and the Iſle of *Rhee*,

At 3 ½ at St. *John de Luz*, at *Bayonne*, and *Memiſſan*.

At 3 ¾ *h*. at *Rohan*, *Brouage*, and *Rochelle*.

At 3 *h*. On the Coaſt of *Poitou*.

At 3 ¾ *h*. at *Olonne* and *Beauvoir*.

On the Coaſt of *Britany*.

At 1 ½ *h*. at *Bell-Iſle*.

At 3 *h*. at the Mouth of the *Loyre*, at *Garande*, *Morbihan*, *Blavet*, and *Concarneau*.

At ¾ *h.* at *Apenars*, *Vannes*, and *Auray*.
At 2 ¼ *h.* at *Apenmark*, *Audierne*, the Race of *Fontenay*, and *Le Conquet*.
At 2¾ *h.* at *Breſt*, and at Cape de *Four*.
At 4 *h.* at St. *Paul de Leon*.
At 4½ *h.* at *Port Blanc*.
At 6 *h.* at St. *Malo* and *Cancale*.

On the Coaſt of *Normandy*.

At 7 *h.* at *Granville*, and *Barneville*.
At 8 *h.* at *Cherbourg* and *Barfleur*.
At 9 *h.* at *Caen* and *Honfleur*, at the Mouth of the *Seine*, and at *Havre de Grace*.
At 9¼ *h.* at *Feſcan*, and St. *Valeri*.
At 10 ½ *h.* at *Rouen*, *Dieppe*, and *Treport*.

On the Coaſt of *Picardie*.

At 11. *h.* at the Mouth of the *Somme*, at *Eſtaple*, *Bolgne*, and *Ambletenſe*.
At 11 *h.* at *Calais*.
At 12 *h.* at *Dunkirk*, *Newport* and *Oſtend*.

At Bermudas, *by* Mr. Rich. Norwood, n 30. p. 565.

9. 1. I have only taken a general notice of the *Tides*, as that it is high water about 7 of the Clock on the *Change-day* (in ſome *Creeks* an Hour or 2 later.) The *Water* riſeth but little, as about 4 Foot at *High-water*, but at *Spring-Tides* it may be a Foot more. The *Tides* without are very various in their *Setting*: ſometimes the Tide of Flood ſets to the Eaſtward, ſometimes to the Weſtward, but in fair, calm, and ſetled Weather, the ſaid Tide ſets from the South-Eaſt toward the North-Weſt, as they ſay.

By Mr. Rich. Stafford, n. 40. p. 792.

2. The Water about our Iſland (*Bermudas*) does not flow, by any Man's Obſervation, above 5 Foot; and that but at one Seaſon of the Year, between *Michaelmas* and *Chriſtmas*; at other Times not above 3 Foot. It is high Water when the Moon is about an Hour high, and the like after her going down. It flows in from the *North-weſt*, and runs to the *South-eaſt* neareſt, and in that part of the Land which lies moſt to the *North-weſt* there it is high water ſooneſt: But the Tide does not always ebb and flow directly that Courſe round about our Coaſt; but I ſuppoſe, the Reaſon is, that ſome points of Land, or Shoals may turn its North-weſt and South-Eaſt Courſe.

At Cabo Cors *Caſtle on the Coaſt of* Guinea, *by* Mr. Heathcot, n. 158. p. 573.

10. The Sea runs here along the Shore continually to the *Eaſtward*, at a very great Rate except at Full and Change; for then it runs to weſtward, or at leaſt makes a great Abate. *Nov.* 24. 1683. I took the Time of the high Water at the *Caſtle* (as near as I could) at 2 *h.* 30. *p. m.* it flowed about 6 Foot.

An Hypotheſis *about the* Flux *and* Reflux *of Sea by Dr.* Wallace, n. [illegible] p. 263.

V. 1. The *Sea's Ebbing* and *Flowing* hath ſo great a Connexion with the Moon's motion, that in a manner all *Philoſophers* (whatever other Cauſes they have joyned with it) have attributed much of its Cauſe to the *Moon*; which either by ſome *occult Quality*, or particular Influence which it hath on moiſt Bodies, or by ſome *magnetick Vertue*, drawing the Water towards it, (which ſhould therefore make the Water there higheſt, where the *Moon* is vertical) or by its Gravity and Preſſure downwards upon the Terraqueous Globe (which ſhould make it loweſt where the *Moon* is vertical) or by whatever other means (according to the ſeveral conjectures of inquiſitive Perſons) hath ſo great an Influence on, or at leaſt a Connexion with the *Sea's Flux* and *Reflux*, that it would ſeem very unreaſonable to ſeclude the conſideration of the Moon's motion from that of the *Sea*: The *Periods* of *Tides* (to ſay nothing of the greatneſs of them near the *New-moon*, and *Full-moon*) ſo conſtantly waiting on the *Moon*'s Motion, that it may be well preſumed, that either the one is governed by the other, or at leaſt both from ſome common cauſe.

The firſt that I know of, who took in the conſideration of the Earth's motion, (*Diurnal* and *Annual*) was *Galilæo*: Who in his *Syſtem of the World*, hath a particular and very rational Diſcourſe on this Subject. But that Diſcourſe is to be look'd upon only as an Eſſay of the general Hypotheſis; which as to particulars, was to be afterwards adjuſted from a good *General Hiſtory of Tides*; which it's manifeſt enough that he had not; and which is yet in a great Meaſure wanting.

And what I ſay of *Galilæo*, I muſt in like manner deſire to be underſtood of what I am now ready to ſay to you. For I do not profeſs to be ſo well ſkill'd in the *Hiſtory* of *Tides*, as that I will undertake preſently to accommodate my general Hypotheſis to the particular Caſes; or that I will indeed undertake for the certainty of it, but only as an Eſſay propoſe it to further Conſideration, to ſtand or fall, as it ſhall be found to anſwer matter of Fact.

I conſider therefore that in the *Tides*, or the *Flux* and *Reflux* of the Sea, beſides extraordinary Extravagances, or Irregularities, whence great Inundations, or ſtrangely high Tides do follow, (which yet perhaps may prove not to be ſo meerly accidental as they have been thought to be, but might from the regular Laws of Motion, if well conſidered, be both well accounted for, and even foretold; there are theſe 3 Notorious Obſervations made of the *Reciprocation* of Tides. Firſt the *Diurnal Reciprocation*, whereby twice in ſomewhat more than 24 Hours, we have a Flood and an Ebb; or a high Water and low Water. *Secondly*, the *menſtrual*; whereby in one *Synodical Period* of the Moon, ſuppoſe from *Full-moon* to *Full-moon*, the Time of thoſe *Diurnal Viciſſitudes* doth move round thro' the whole Compaſs of the Νυχθήμερον, or Natural Day of 24 Hours: As for inſtance, if at the *Full-moon*, the *Full Sea* be at ſuch or ſuch a place juſt at Noon, it ſhall be the next Day, at the ſame place, ſomewhat before one of the Clock; the day following, between One and 2.; and ſo onward, till at the New-Moon it ſhall be at Midnight; (the other Tide, which in the *Full-moon* was at *midnight*, now the *New-Moon* coming to be at Noon); and ſo forward till at the next Full-moon the full Sea ſhall at the ſame place come to be at Noon again. Again, That of the Spring Tides and Neap-tides, as they are call'd, about the Full moon and New-moon the Tides are at the higheſt, at the *Quadratures* the Tides are at the loweſt: and at the Times intermediate proportionably. 3*dly*, the *Annual*; whereby it is obſerved, that at ſome times of the Year the *Spring-tides* are yet much higher than the *Spring-tides* at other times of the Year: Which times are uſually taken to be at the *Spring* and *Autumn*, or the two *Æquinoxes*; but I have Reaſon to believe, (as well from my own Obſervations for many Years, as of others, who have been much concerned to heed it, whereof more will be ſaid by and by;) that we ſhould rather aſſign the beginning of *February* and *November*, than the two *Equinoxes*.

1 Now in order to give an account of theſe 3 Periods, according to the Laws of Motion and Mechanick Principles; we ſhall firſt take it for granted what is now a-days pretty commonly entertained by thoſe who treat of ſuch matters; that a Body in *motion* is apt to *continue* in its *motion*, and that in the ſame degrees of *Celerity*, unleſs hinder'd by ſome contrary *Impediment*: like as a Body at reſt to continue ſo, unleſs by ſome ſufficient Mover, put into Motion: And accordingly, which daily Experience teſtifies, if on a Board or Table, ſome looſe incumbent Weight be for ſome time *moved*, and have thereby contracted an *Impetus* to *motion* at ſuch a *rate*, if that Board or Table chance by ſome external obſtacle, or otherwiſe, to be ſtopped, or conſiderably retarded in its motion, the incumbent looſe Body will ſhoot forward upon it; and contrariwiſe, in caſe that Board or Table chance to be accelerated or put forward with a conſiderably greater ſpeed than before, the looſe incumbent body not having yet obtained an equal *Impetus* with it, will be left behind, or ſeem to fly backward upon it. Or, which is *Galilæo*'s Inſtance, if a broad Veſſel of Water, for ſome time evenly carried forward with Water in it, chance to meet with a Stop, or to ſlack its motion, the Water will daſh forward and riſe higher at the fore part of the Veſſel; and contrariwiſe, if the Veſſel be ſuddenly put forward faſter than before, the Water will daſh backwards, and riſe at the hinder part of the Veſſel. So that an Acceleration or *Retardation* of the Veſſel which carries it, will cauſe a riſing of the Water in one part, and a falling in another; which yet by its own Weight, will again be reduced to a Level as before. And conſequently, ſuppoſing the *Sea* to be but as a looſe Body carried about with the Earth, but not ſo united to it as neceſſarily to receive the ſame degree of *Impetus* with it, as its fixed parts do, The *Acceleration* or *Retardation* in the motion of this or that part of the Earth, will cauſe, more or leſs, according to the Proportion of it, ſuch a *Daſhing* of the Water, or *Riſing* at one part, with a *Falling* at another, as is that which we call the Flux and Reflux of the Sea.

Now this premiſed, we are next, with him, to ſuppoſe the Earth carried about with a double Motion, the one *Annual* in *BEC*, the great Orb, in which the Center of the Earth *B*, is ſuppoſed to move about the Sun *A*. The other Diurnal, whereby the whole moves upon its own *Axis*, and each in its ſurface deſcribes a Circle, as *DEFG*.

It is then manifeſt, that if we ſuppoſe that the *Earth* moved but by any one of theſe *motions*, and that regularly with an equal *Swiftneſs*, the *Water* having once attained an equal *Impetus* thereunto, would ſtill hold equal pace wit it, there being no occaſion, from the quickning or ſlackning of the *Earth's motion*, in that part where the *Water* lieth, for the *Water* thereon either to b

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caſt Forward or Backward, and thereby to *Accumulate* on the other parts of the *Water*: But the true Motion of each part of the Earth's Surface being compounded of thoſe Two *Motions*, the *Annual* and *Diurnal*; (the *Annual* in *BEC*, being, as *Galilao* there ſuppoſeth, about three times as faſt as a *Diurnal Motion* in a great Circle, as *DEF*;) while a point in the *Earth*'s Surface moves about its Center *B*, from *G*, to *D*, and *E*, and at the ſame time its Center *B*, be carried forwards to *C*; the true *Motion* of that Point forwards, is made up of both thoſe *Motions*; to wit, of *B* to *C*, and of *G* to *E*; but while *G*, moves by *D*, to *E*, *E* moves backward by *F*, to *G*, contrary to the motion of *B*, to *C*; ſo that the true motion of *E*, is but the difference of *BC*, and *EG*: (for, beſides the motion of *B*, above the Center; *G*, is alſo put forward as much as from *G*, to *E*; and *E* put backward as much as from *E* to *G*:) ſo that the *Diurnal motion*, in that part of the *Earth*, which is next the *Sun*, as *EFG*, doth abate the progreſs of the *Annual*, and moſt of all at *F*; and in the other part, which is from the *Sun*, as *GDE*, it doth Increaſe it, and moſt of all at *D*, that is in the *Day* time there is abated, in the *Night* time is added, to the *Annual* Motion, about as much as is *GE*, the *Earth*'s Diameter. Which would afford us a Cauſe of two *Tides* in 24 *hours*; the one upon the greateſt *Acceleration* of *Motion*, the Other upon its greateſt *Retardation*.

2. And thus far *Galilao*'s Diſcourſe holds well enough; but then in this it comes ſhort; that as it gives an Account of *Two Tides*, ſo thoſe *Two Tides* are always to be at *F*, and *D*; that is at *Noon* and at *Midnight*: Whereas Experience tells us, that the time of *Tides*, moves in a Months ſpace through all the 24 Hours; of which he gives us no Account. For though he do take notice of a *Menſtrual Period*; yet he doth it only as to the Quanity of the *Tides*, greater or leſs; not as to the Time of the *Tide*, ſooner or later.

To help this *J. Bapt. Balianus* makes the *Earth* to be but a *Secondary* Planet, and to move not directly about the *Sun*, but about the *Moon*, the *Moon* mean while moving about the *Sun*, in like manner as we ſuppoſe the *Earth* to move about the *Sun*, and the *Moon* about it. But though this might furniſh us with the Fundation of a *Menſtrual Period* of *Accelerations* and *Retardations* in the Compound Motion of ſeveral parts of the *Earth*'s Surface, yet there is no good reaſons to admit of this *Hypotheſis*.

Ricciol. *Alm. Nov.* *Tom.* 1. l. 4. c. 10. n. 11, 12. p. 216. a.

Inſtead of this, that *Surmiſe* of mine, (for I dare not yet, with confidence, give it any better name) of what I have ſpoken to you heretofore, (and which hath occaſioned this preſent account which I am now giving you) is to this Purpoſe.

The *Earth* and *Moon* being known to be Bodies of ſo great Connexion, as that the *Motion* of *One* follows that of the *Other*, may well enough be looked upon as one Body, or rather one Aggregate of Bodies, which have one common Center of Gravity, which Center of Gravity according to the known Laws of *Staticks*) is in a ſtraight Line Connecting their reſpective Centers, ſo divided as that its parts be in Reciprocal Proportion to the Gravities of the two Bodies. As for Example, Suppoſe the *Magnitude* (and therefore, probably, the Gravity) of the *Moon* to be about a *One and fortieth* part of that of the *Earth*: And the Diſtance of the *Moon*'s Center from the Center of the *Earth*, to be about 56 *Semidiameters* of the *Earth*, the diſtance of the Common Center of Gravity of the two Bodies, will be from that of the *Earth* about $\frac{1}{42}$ of 56 *Semi-diameters*, that is about $\frac{1}{3}$ of a *Semidiameter* of the *Earth*, above its Surface, in the Air, directly between the *Earth* and *Moon*.

Now ſuppoſing the *Earth* and *Moon*, jointly as One Body, carried about by the *Sun*, in the *Great Orb* of the *Annual* Motion; this Motion is to be eſtimated, (according to the Laws of *Staticks* in other Caſes) by the Motion of the Common Center of Gravity of both Bodies. For we uſe in *Staticks* to eſtimate a Body, or Aggregate of Bodies, to be moved upwards, downwards or otherwiſe, ſo much as its Common Center of Gravity is ſo moved, howſoever the Parts may change places amongſt themſelves.

And accordingly the Line of the *Annual* Motion will be deſcribed, not by the Center of the *Earth* (as we commonly eſtimate it) but by the Common Center of Gravity of the Bodies, *Earth* and *Moon*, as one Aggregate.

Fig. 52. Now ſuppoſing *ABCDE*, to be a part of the *Great Orb* of *Annual Motion*, deſcribed by the Common Center of Gravity, in ſo long time as from a *Full Moon* at *A*, to the next *New Moon* at *E*; the Center of the *Earth* at *T*, and that of the *Moon* at *L*, muſt each of them, (ſuppoſing their *Common Center* of *Gravity* to keep the Line *AE*) be ſuppoſed to deſcribe a Periphery about that *Common Center*, as the *Moon* deſcribes her Line of *Menſtrual motion*. And in like manner, *EFGHI*, from the *New Moon* at *E*, to the next *Full Moon* at *I*.

ig. 53. From *A* to *E*, (from Full Moon to New Moon) *T* moves (in its own *Epicycle*) upwards from the Sun: And from *E* to *I*, (from New Moon to Full Moon) it moves downwards, towards the Sun. Again, from *C* to *G*, (from Laſt Quarter to the following Firſt Quarter) it moves forward according to the *Annual* Motion; but from *G* forwards to *C*, (from the Firſt Quarter to the enſuing *Laſt Quarter*) it moves contrary to the *Annual* Motion.

It is manifeſt therefore, according to this *Hypotheſis*, that from the Laſt Quarter to the Firſt Quarter (from *C* to *G*, while *T* is above the Line of the *Annual* Motion) its *Menſtrual* Motion in its *Epicycle* adds ſomewhat of *Acceleration* to the *Annual* Motion; and moſt of all at *E*, the New Moon: And from the Firſt to the Laſt Quarter (from *G* forward to *C*, while *T* is below the Line of the *Annual* Motion) it abates of the *Annual* Motion; and moſt of all at *I*, or *A* the Full Moon.

So that in purſuance of *Galilæo*'s Notion, the *Menſtrual* Adding to, or Detracting from the *Annual* Motion, ſhould either leave behind, or caſt forward the looſe Waters incumbent on the *Earth*, and thereby cauſe a *Tide*, (or Accumulation of Waters) and moſt of all at the Full Moon and New Moon, where thoſe *Accelerations* or *Retardations* are greateſt.

Now this *Menſtrual* Motion, if nothing elſe were ſuperadded to the *Annual*, would give us two *Tides* in a Month, and no more; (the one upon the *Acceleration*, and the other on the *Retardation*) at New Moon and Full Moon; and two Ebbs at the two Quarters; and in the Intervals, Riſing and Falling Water.

But the *Diurnal* motion ſuperadded, doth the ſame to this *Menſtrual*, which *Galilæo* ſuppoſeth it to do to the *Annual*; that is, doth Add to, or Subſtract from the *Menſtrual Acceleration* or *Retardation*; and ſo gives us *Tide upon Tide*.

For in whatſoever part of its *Epicycle* we ſuppoſe *T* to be; yet becauſe, *Fig.* 54. while by its *Menſtrual* Motion, the Center moves in the Circle *LTN*; each Point in its Surface, by its Diurnal Motion moves in the Circle *LMN*: Whatever Effect (Accelerative or Retardative) the *Menſtrual* would give, that Effect by the Diurnal is Encreaſed in the Parts *LMN*, (or rather *lMn*, the Semicircle) and moſt of all at *M*; but diminiſhed in the Parts *NOL* (or rather *n O l*) and moſt of all at *O*. So that at *M* and *O*, (that is when the Moon is in the *Meridian* below or above the Horizon) we are to have the *Diurnal Tide* or *High-Water*, occaſion'd by the greateſt *Acceleration* or Retardation, which the *Diurnal Arch* gives to that of the *Menſtrual*; which ſeems to be the true cauſe of the *Daily Tides*, and withal gives an Account, not only why it ſhould be every Day, but likewiſe why at ſuch a time of the Day; and why this time ſhould in a Month run through the whole 24 Hours, *viz.* becauſe the Moon's coming to the *Meridian* above and below the Horizon, (or as the Sea-men call it, the Moon's *Southing* and *Northing*) doth ſo: and likewiſe of the *Spring Tides* and *Neap Tides*. For, when it ſo happens, that the *Menſtrual* and *Diurnal Accelerations* or *Retardations*, be coincident, (as at the New Moons and Full Moons they are) the Effect muſt needs be the greater. And although (which is not to be diſſembled) this happen but to One of the Two *Tides*; that is, the *Night-Tide* at the New Moon (when both motions do moſt of all *Accelerate*) and the *Day-Tide* at Full Moon (when both do moſt Retard the *Annual* Motion;) yet, this *Tide* being thus raiſed by two concurrent cauſes; tho' the next *Tide* have not the ſame cauſe alſo, the *impetus* contracted, will have influence upon the next *Tide*; upon a like Reaſon, as a *Pendulum* let fall from a higher *Arch*, will (tho' there be no new Cauſe to occaſion it) make the Vibration on the other ſide (beyond the Perpendicular) to be alſo greater: Or, of Water in a broad Veſſel, if it be ſo jogged, as to be caſt forward to a good height above its Level, will upon its Recoiling, by its own Gravity, (without any additional Cauſe) mount ſo much the higher on the hinder part.

But here alſo, we are to take notice, that though all parts of the Earth by its *Diurnal* Motion, do turn about its Axis, and deſcribe Parallel Circles; yet not equal Circles; but greater near the *Æquinoctial*, and leſſer near the Poles, which may be a Cauſe why the *Tides* in ſome parts may be much greater than in others. But this belongs to the particular Conſiderations, (of which we are not now giving an Account) not to the General *Hypotheſis*.

3. The *Annual High Tides* having been obſerved (groſly) to happen about the *Spring* and *Autumn*, they are generally referred to the two *Æquinoxes*. But the Inhabitants of *Rumney-marſh* in *Kent*, where the Sea being kept out with great Earthen Walls, that it doth not at *High Water* overflow the Level; are generally agreed by their Obſervations, (and Experience dearly bought) that their Times of Danger are about the beginning of *February* and of *November*: That is, at thoſe *Spring Tides* which happen near thoſe Times; to which they give the Names of *Candlemaſs Stream*, and *Allhallond Stream*: And if they eſcape thoſe *Spring Tides*, they apprehend themſelves

out of Danger for the reſt of the Year. And as for *March* and *September* (the two *Æquinoxes*) they are as little ſollicitous of them, as of any other part of the Year. And I have my ſelf very frequently obſerved (both at *London*, and elſewhere) that in thoſe Months of *February* and *November*, (eſpecially *November*) the Tides have run much higher than at other times; particularly in *November* 1660. I found the Water ſo High in *King-ſtreet Weſtminſter*, that it came up not only into the Boots, but into the Body of the Coach; and the *Pallace-Yard* (all, ſave a little place near the Weſt End) over-flowed; as likewiſe the Market-Place; and many other places; and their Cellars generally filled up with Water. And in *November* 1665. it may be well remembred what very High Tides there were, not only on the Coaſts of *England* (where much hurt was done by it) but much more in *Holland*, where, by reaſon of thoſe Inundations, many Villages and Towns were overflowed.

'Tis true, there does not happen any ſingle Signal Accident, which might caſt it on theſe times, yet there is a Compound of Two that may do it: Which is the *Inequality* of the *Natural Day*, (well known to *Aſtronomers*) ariſing from a double Cauſe. *Firſt*, Becauſe the Sun, by reaſon of its *Apogæum* and *Perigæum*, doth not at all times of the Year diſpatch, in one Day, an equal Arch of the *Eclip̄tick*: *Secondly*, Equal Arches of the *Ecliptick* do not in all parts of the *Zodiack* anſwer to equal Arches of the *Æquinoctial*, by which we are to Eſtimate Time.

According to the Firſt of theſe Cauſes, we ſhould have the longeſt Natural Days in *December*, and the ſhorteſt in *June*, which if it did operate alone, would give us at thoſe times two *Annual High Waters*. According to the Second Cauſe, if operating ſingly, we ſhould have the longeſt Days in the two *Solſtices* in *June* and *December*, and the two ſhorteſt at the *Æquinoxes*, in *March* and *September*; which would at thoſe times give occaſion of Four *Annual High Waters*.

But the True Inequality of the Natural Days, ariſing from a Complication of thoſe two Cauſes, ſometimes Croſſing, and ſometimes Promoting each other, though we ſhould find ſome Increaſes or Decreaſes of the Natural Days, at all thoſe Seaſons anſwerable to the reſpective Cauſes, (and perhaps of *Tides*, proportionably thereunto: Yet the longeſt and ſhorteſt Natural Days abſolutely of the whole Year (ariſing from this Complication of Cauſes) are about thoſe times of *Allhallontide* and *Candlemaſs*; (or not far from them) about which thoſe *Annual High Tides* are found to be: As well appear by the *Tables of Æquation* of *Natural Days*. And therefore, I think, we may with very good Reaſon, caſt this *Annual Period* upon that cauſe, or rather Complication of Cauſes. For (as we before ſhewed in the *Menſtrual* and *Diurnal*) there will, by this Inequality of Natural Days ariſe a Phyſical *Acceleration* and *Retardation* of the *Earth*'s Mean Motion, and accordingly a caſting of the Waters Backward or Forward; either of which will cauſe an Accumulation or High Water.

I muſt here add, (that I be not miſtaken) that whereas I caſt the Time o the *Daily Tides* to be at all Places, when the Moon is there in the Meridian it muſt be underſtood of *open Seas*, where the Water hath ſuch free Scope for its Motion, as if the whole Globe of Earth were equally covered with Water: Well knowing, that in *Bays* and *Inland Channels*, the poſition of the Banks and other like Cauſes muſt needs make the times to be much different from what we ſuppoſe in the *open Seas*: And likewiſe, that even in the *open Seas*, *Iſlands*, and *Currents*, *Gulfs* and *Shallows*, may have ſome Influence, though not comparable to that of the *Bays*, and *Channels*. And moreover, though I think that Sea-men do commonly reckon the time of *High Water* in the open Seas, to be then, when the Moon is there in the Meridian (as this *Hypotheſis* would caſt it:) Yet I do not take my ſelf to be ſo well furniſhed with a Hiſtory of *Tides*, as to aſſure my ſelf of it; much leſs to Accommodate it to particular Places and Caſes.

It may be thought perhaps, that if the Earth ſhould thus deſcribe an *Epicycle* about the Common Center of Gravity, it would (by this its change of place) diſturb the Celeſtial Motions, and make the apparent Places of the Planets, eſpecially ſome of them, different from what they would otherwiſe be. For though ſo ſmall a removal of the Earth, as the *Epicycle* would Cauſe, (eſpecially if its Semi-diameter ſhould not be above $1\frac{1}{3}$ of the Earth's Semi-diameter) would ſcarce be ſenſible, if at all, to the remoter Planets; yet as to the nearer it might.

To this my Anſwer is, That ſuch difference hath been obſerv'd, and hath very much Puzzl'd *Aſtronomers* to give an Account of. Mr. *Horrocks* was fain to have recourſe to ſomewhat like *Kepler*'s *Amicable Fibres* (which he had no affection to at all) to give Account of the Inequalities of the Moon's Motion. And other *Aſtronomers* have introduced (ſome upon one Suppoſition, ſome upon another) ſome kind of *Menſtrual Æquation*, to ſolve the Inequalities of the Moon's Motion, according to her *Synodical* Revolution, or different Aſpects (of New Moon, Full Moon, *&c.*) beſides what concerns her one Periodical Motion. For which, this Conſideration of the Common Center of Gravity of the Earth and Moon, is ſo proper a Remedy (eſpecially if it ſhould be found preciſely to anſwer thoſe *Phænomena*, which I have not Examined, but am very apt to believe) that it is ſo far from being, with me an Objection againſt it, that it is one of the Reaſons, which make me Inclinable to introduce it.

The like Conſideration may reaſonably be had of *Jupiter* and *Saturn*, and their *Satellites*, which yet, becauſe of their ſmallneſs, may chance to be ſo little, as that at this diſtance, the Change of their Apparent Places may not be diſcernable. For all theſe *Satellites* are to their Principals, as ſo many Moons to the Earth. And Mr. *Horrocks* expreſſeth ſome ſuch little Inequalities in *Saturn*'s Motion, of which he could not imagine what Account to give: Which, for ought I know, might have been accounted for, if at that time the *Satellites* of *Saturn* had been diſcovered, and that Mr. *Horrocks* had thought of ſuch a Notion as the Common Center of Gravity of *Saturn* and his Companions, to be conſiderable, as to the guiding of his *Motion*.

Some Objections Anſwered; By Dr. Wallis. *ib.* p. 281.

2. 1. To the firſt Objection, *That it appears not how two Bodies, that have no Tye, can have one common Center of Gravity*: That is (for ſo I underſtand the Intendment of the Objection) can Act or be Acted in the ſame manner, as

if they were Connected; I ſhall only Anſwer, that it is harder to ſhew how they have, than that they have. That the Load-ſtone and Iron have ſomewhat Equivalent to a Tye though we ſee it not, yet by the Effects we know. And it would be eaſie to ſhew that two Load-ſtones, at once applied, in different poſitions, to the ſame Needle, at ſome convenient diſtance, will draw it not to Point directly to either of them, but to ſome Point between both; which Point is, as to thoſe two, the Common Center of *Attraction*; and it is the ſame as if ſome one Loadſtone were in that Point. Yet have theſe two Load-ſtones no Connexion or Tye, though a Common Center of Virtue, according to which they joyntly Act. And that there is ſomewhat that doth Connect the Earth and Moon, (as much as what Connects the Loadſtone, and the Iron which it draws,) is paſt doubt to thoſe, who allow them to be carried about by the Sun, as one Aggregate or Body, whoſe parts keep a reſpective Poſition to one another: Like as *Jupiter* with his four *Satellites*, and *Saturn* with his one.

2. To the Second Objection; *That at* Chatham *and in the* Thames, *the Annual Spring Tides, happen about the* Æquinoxes; *not* (*as this Hypotheſis doth Suppoſe elſewhere to have been obſerved*) *about the beginning of* February *and* November. If their meaning be, that *Annual High Tides*, do then happen, and then only, if this prove true, it will eaſe me of half my work: For it is then eaſily anſwered, that it depends upon the *Obliquity* of the *Zodiack*, the parts of the *Æquinoctial* anſwering to equal parts of the *Zodiack*, being near the *Solſtitial* points greateſt, and near the *Æquinoctial* points leaſt of all. But beſides, this *Annual* Viciſſitude of the *Æquinoxes*, not to ſay of the four *Cardinal Points* (which my *Hypotheſis* doth allow and aſſert) I believe it will be found, that there is another *Annual* Viciſſitude anſwering to the *Sun's Apogæum* and *Perigæum*. And that the greateſt Tides of all will be found to be upon a Reſult of theſe two Cauſes cooperating. And to what is ſaid to be obſerved at *Chatham*, and in the *Thames*, contrary to that I alledge as obſerved in *Rumney Marſh*; I muſt at preſent ἀπέχειν, and refer to a *melius inquirendum*. For a good Diary of the Height and Time both of High Water, and Low-Water, for a Year or two together; even at *Chatham*, or *Greenwich*; but rather at ſome place in the open Sea, or at the *Land's End* in *Cornwal*, or on the Weſt Parts of *Ireland*; or at St. *Helen's* or the *Bermudas*, &c. would do more to the reſolving of this Point, than any Verbal Diſcourſe without it.

3. To the third Objection, *That ſuppoſing the Earth and Moon to move about a Common Center of Gravity; if that the Higheſt Tides, be at the* New Moon *when the* Moon *being neareſt to the* Sun, *the* Earth *is fartheſt from it, and it's Compound motion at the Swifteſt; and that the Tides Abate as the* Earth *approacheth nearer, till it comes into the ſuppoſed Circle of her* Annual Motion; *It ma be demanded, why do they not ſtill Abate as the* Earth *comes yet nearer to th* Sun *and the Swiftneſs of its Compound motion, ſtill Slackens? And ſo, wh have we not Spring-Tides at the* New Moon (*when the motion is Swifteſt*) *an Neap-Tides at* Full Moon (*when the motion is ſloweſt*;) *But a Spring-Tid at both?* The Anſwer, if obſerved, is already given in my *Hypotheſis* it ſelf

Becauſ

Becauſe the Effect is indifferntly to follow, either upon a Suddain *Acceleration*, or a ſudden *Retardation*. Now both of theſe happening, the One at the New Moon the other at the Full Moon, do cauſe High Tides at both.

4. To the 4th Objection, *That the* Higheſt Tides *are not at all places, about the* New Moon, *and* Full Moon; *and particularly, that in ſome places of the* Eaſt-Indies, *the* Higheſt Tides *are at the* Quadratures: I Anſwer in general; That as to the particular *Varieties* of *Tides* in ſeveral Parts of the World, I cannot pretend to give a Satisfactory account, for want of a competent Hiſtory of *Tides*, &c. Becauſe, as is intimated in what I wrote in the general, the Various Poſitions of *Channels*, *Bays*, *Promontories*, *Gulfs*, *Shallows*, *Currents*, *Trade-Winds*, &c. muſt needs make an innumerable Variety of Accidents in particular places, of which no ſatisfactory account is to be given from the general *Hypotheſis*, though never ſo true, without a due conſideration of all thoſe. Which is a Task too great for me to undertake, being ſo ill furniſhed with Materials for it.

5. To the 5*th* Objection, *That, the Spring-Tides happen not with us juſt at the* Full *and* Change, *but two or three days after*: I ſhould with the more confidence attempt an Anſwer, were I certain, whether it be ſo in the open *Seas*, or only in our *Channels*. For the Anſwers will not be the ſame in both Caſes. If only in our *Channels*, where the *Tides* find a large indraught; but not in the open Seas: We muſt then ſeek a Reaſon of it from the particular Poſition of theſe places. But if it be ſo generally in the wide open Seas: We muſt then ſeek a Reaſon of it from the general *Hypotheſis*. And, till I know the matter of Fact, I know not well which to offer at. I know that Mariners uſe to ſpeak of *Spring Tides* at the New and Full of the Moon; though I have ſtill had a ſuſpicion that it might be ſome Days after, as well in the open Seas, as in our narrower *Channels*. And therefore I have choſen to ſay, in my Papers, About the New and the Full, rather than at the New and Full; and even when I do ſay At, I intend it in that laxer ſence in which I ſuppoſe the Mariners are to be underſtood, for Near that Time. The truth is, the Flux and Reflux of Water in a Veſſel by reaſon of the jogging of it; though it follow thereupon; yet is, for the moſt part, diſcernable ſome time after. For there muſt, upon that Jog, be ſome time for Motion, before the Accumulation can have made a *Tide*. And ſo I do not know but that we muſt Allow it in all the Periods: But in my Conjectural *Hypotheſis*, while it is yet but a Candidate, I did not think my ſelf oblig'd to ſpeak more nicely.

But now, after all, the Cleareſt Evidence for this *Hypotheſis*, if it can be had, will be from *Celeſtial* Obſervations. As for inſtance; Suppoſing the Sun at *S*, the *Earth*'s Place in its *Annual Orb*, at *T*; and *Mars* (in Oppoſition to the *Sun* or near it) at *M*: From whence *Mars* ſhould appear in the *Zodiack* at γ, and will at Full Moon be ſeen there to be, the Moon being at *C*, and the *Earth* at *C*; and the like at the New-Moon. But if the Moon be in the Firſt Quarter at *A*, and the Earth at *a*; *Mars* will be ſeen, not at γ, but at α; too Slow: And when the Moon is at *B*, and the Earth at *b*, *Mars* Fig. 55.

will be ſeen at β; yet too Slow: Till at the Full Moon, the Moon at *C* the *Earth* at *c*, *Mars* will be ſeen at γ, its true Place, as if the *Earth* were at *T*. But then after the Full, the Moon at *D* the Earth at *d*; *Mars* will be ſeen, not at γ, but at δ; too Forward, and yet more when the Moon, at the Laſt Quarter, is at *E*, the Earth at *e*, and *Mars* ſeen at ε. If therefore *Mars*, when in *Oppoſition* to the *Sun*, be found, all other allowance being made, ſomewhat too Backward before the Full Moon, and ſomewhat too Forward after the Full Moon, and moſt of all, at the Quadratures, it will be the beſt confirmation of the *Hypotheſis*. The like may be fitted to *Mars* in other Poſitions, *mutatis mutandis*, and ſo for the other Planets.

But this Proof, is of like nature as that of the Parallaxis of the Earth's *Annual Orb* to prove the Copernican Hypotheſis. If it can be obſerved, it proves the Affirmative, but if it cannot be obſerv'd, it doth not convince the Negative, but only proves that the Semidiameter of the Earth's Epicycle is ſo ſmall as not to make any diſcernable Parallax. And indeed I doubt that will be the Iſſue. For the Semidiameter of this Epicycle, being little more than the Semidiameter of the Earth it ſelf, or about 1$\frac{1}{2}$ thereof, as is conjectured, in the Hypotheſis, from the Magnitudes and Diſtances of the Earth and Moon compared, and there having not as yet been obſerved any Diſcernable Parallax of *Mars*, even in his neareſt Poſition to the Earth, it is very ſuſpicious, that here it may prove ſo too.

The Variety of the Annual Tides, *in ſeveral Places of* England, *Conſidered*; *By* Dr. Wallis, n. 34. p. 652.

3. In my Hypotheſis for Tides, I caſt the Annual High Tides for the Coaſt of *Kent*, and conſequently the Rivers of *Thames* and *Medway*, about the beginning of *November* and *February*: Which agrees with Obſervations on thoſe Coaſts, and particularly with that of yours [Mr. *Oldenburgh*'s] of *Feb.* 5. 166$\frac{7}{8}$.

The laſt year [1667] when I was preſent in the *R. S.* I remember an account was brought us of the *Annual High Tides* on the *Severn*, and at *Cheapſtow-bridge*, to be about the beginning of *March*, and the end of *September*. Which though they agree not with the particular times on the Coaſt of *Kent*, yet in the general they agree thus far, That the one is about as much before the one *Æquinox*, as the other is after the other *Æquinox*. You now acquaint me with the *High-Tides* about *February* 22, about the Coaſt of *Plymouth*, which is later than that of the Coaſt of *Kent*, but ſooner than that on the *Severn*. And I doubt not but that in other parts of the World will be found other Varieties.

The Reaſons of theſe Varieties are, as I have formerly ſignified, to be attributed to the particular Poſition of thoſe Parts rather than to the general Hypotheſis.

Of which this, in brief, may ſerve for ſome account at preſent. The *General Hypotheſis* of the *Earths Diurnal* Motion from Weſt to Eaſt; would caſt that of the *Waters*, not following ſo faſt from Eaſt to Weſt, which cauſeth the *Conſtant Current* within the *Tropicks*, where the Circles are greateſt, *Weſtward* from the Coaſt of *Africa* to that of *America*, which is alſo the Cauſe of the conſtant *Eaſtern Breeze* blowing in thoſe parts. But the Sea thus beating on the Coaſt of *America*, is caſt back as with an *Eddy* on either hand, and conſequently returns from the *American* Shore Eaſtward towards the Coaſt of *Europe*, where the Parallel Circles to the *Æquator* being leſs, and conſequently the *Diurnal Motion* ſlower, doth not caſt the Water ſo ſtrongly weſtwards, as between the *Tropicks*, and ſo not ſtrong enough to overcome the *Eddy*, which it meets with from the other Motion, which gives the Sea a North-Eaſterly Motion on theſe Coaſts; as to its uſual Courſe. The *Current* therefore of our Seas being North Eaſterly, we are next to conſider, at what time it runs more to the North, and at what more to the Eaſt. When it runs moſt Northerly, it runs up the *Iriſh Sea*, and ſo up the *Severn*: When moſt Eaſterly, it runs ſtraight up the *Channel*, and ſo to the Coaſt of *Kent*: When between theſe it beats againſt *Devonſhire* and *Cornwall*, and thoſe parts. We are therefore to conſider, as to the Annual Periods, that the annual motion of the Earth in the *Zodiack*, and the *Diurnal* in the *Æquator*, are not preciſely in the ſame direction, but make an *Angle* of 23½ *Deg.* at the *Æquinoxes*, but run, as it were, parallel at the *Solſtices*; and as they be nearer or farther from theſe points, ſo is the Inclination varied, which ſeveral Directions of Motion do cauſe the compound Motion of both to vary from the Eaſt and Weſt more or leſs, according as the Sun's poſition is farther or nearer the *Solſtices*; and therefore nearer to the *Æquinoxes*. This *Inclination* doth caſt the conſtant *Current* of our Seas more to the North and South, and further from it more to the Eaſt and Weſt; which is the reaſon why the *Current* up the *Iriſh Sea* is nearer to the *Æquinoxes* (at the beginning of *March*, and end of *Sept.*) and up the *Channel* or *narrow Seas*, farther from it (at the Beginning of *Febr.* and of *Nov.*) and againſt the Coaſts of *Devonſhire* and thereabouts, at ſome intermediate Time.

Animadverſions upon Dr. Wallis's Hypotheſis; by Mr. Joſ. Childrey, n. 64 p. 2061.

4. I fear Dr. *Wallis* may be miſtaken about the annual Viciſſitudes of the Tides, which he contendeth to be about *Allhallontide* and *Candlemas*; For,

1. Our *Engliſh Seamen* (who are more to be truſted than the Inhabitants of *Rumney-marſh*) uſe to ſay, that the higheſt Tides in the Year ſeem to happen rather about the Æquinoxes, than thoſe two other aſſigned Times, when the natural days are longeſt and ſhorteſt.

2. If that which he ſuppoſeth ſhould be the Cauſe of the *High Tides*, he mentions at *London* in *Nov.* 1660, and 1665, the like might be expected every *November*; and as frequently in *February*; of which he gives not one Inſtance. But thoſe high Tides in the *Thames* in *November*, if we dare credit the *London Watermen*, are cauſed by the coming down of the *Land Waters*, after a very great Rain, which being encounter'd by the Tide of Flood from the Mouth of the *Thames*, cannot but ſwell to an unuſual Height. To induce us to believe which, we need only conſider, That the latter end of *Octob.* and the beginning of *Nov.* (or rather both thoſe whole Months) are generally the rainieſt part of the whole Year. Now if the great Rains fall ſo that the Land-Waters come down to the flowing part of the *Thames* juſt upon the Full or Change, when the Spring Tides happen, as they did (for Example) *Sept.* 30. 1555. and *Octob.* the 22. 1629, (*Stow* and *Howes* are my *Authors*) thoſe Spring-Tides muſt be the higher, as proceeding from a double Cauſe.

3. There is another thing notoriouſly known by all Seamen to be a cauſe of *high* or *low Tides*, namely the ſitting of the Wind at ſuch or ſuch a point of Compaſs and blowing hard. It is the conſtant ſaying of all *Seamen* in *Kent*, that ever I met with, that the North-weſt Winds make the *higheſt Tides* in the *Thames*, *Medway*, and all the Coaſts about the *South* and *North-forelands*; and likewiſe on the Coaſt of *Holland* and *Flanders*. And the Reaſon they alledge for it is, becauſe, ſay they, that Wind doth with equal Force blow in the Tide of Flood an both Ends of this Iſland of *Britain*, that is, from the Northward between the Coaſts of *Scotland*, *Norway*, and *Jutland*; and alſo from the Weſtward by the Coaſts of *Cornwal*, *Devonſhire*, *Dorſetſhire*, &c. up along the *Sleeve*, and for the ſame Reaſon, they ſay, (and I think truly) that a South-eaſt Wind deads and hinders the Tides there. Agreeably to this I very well remember, when I was a Boy and lived at *Rocheſter*, that when the *Tides* were unuſually high, the Wind was always *N. W.* and the Moon near the Full or Change. And the Inhabitants about *Chatham*, the Hundred of *Hoo*, and the Iſle of *Graine*, will with one Voice ſay, that they never fear their low Marſhes being overflowed by the *Tide*, but when the Wind is at *N. W.* or thereabouts, upon the *Spring Tides*. Here at *Weymouth*, thoſe able and antient *Sea-men*, I have talked with, tell me, that a *S. S. E.* Wind makes the greateſt *Tides*, and that according to the Degree of the Wind, *cæteris paribus*, the *Tides* riſe more or leſs notably, but that they never obſerve any extraordinary *ſwelling Tides* about *Allhallontime* or *Candlemas*, unleſs the Wind be about *S. S. E.* And the Reaſon they give for that Wind's raiſing the Tides there, is in my opinion very convincing, if we conſider the lying of the *Haven* in the *map*. And for the ſame Reaſon, I ſuppoſe, the Wind from the ſame Point may make the *higheſt Tides* at *Southampton*, a weſterly Wind at *Briſtol* and *Severne*; an eaſterly Wind at *Hull*; a North-eaſt Wind at *Wiſbych* and *Lynn*; a ſoutherly Wind upon the oppoſite Coaſts of *England* and *Ireland*, &c. And I am confident if more particular Enquiry be made in *Rummy-marſh*, it will be found, that *Dimchurch Wall* is never in Danger of being overflowed or broken by the Tides, but upon very ſtormy and tempeſtuous weather; eſpecially when the Wind either blows right on upon the ſhore, or when it ſits in that point that raiſeth the Tides higheſt there. And if we do but conſider that *Allhallontide* and *Candlemas* are no more famous for the longeſt and ſhorteſt natural days than they are generally infamous for ſtormy Weather; eſpecially the former Seaſon, (*Wet* and *Windy* Weather being moſt concomitant) we have good ground to attribute *high tides* at thoſe times of the Year to another Cauſe than the Author ſuppoſeth, and make a more than probable Conjecture at the occaſion of the Miſtake. It is true, *March* is very often more ſtormy than *February*, (tho' ſeldom ſo ſtormy as *October* and *November*) which poſſibly might occaſion that Opinion, which ſome hold, (of which Number *Pliny* is one) that the higheſt Tides are about the Æquinoxes. And if the thing were found to hit pretty frequently in *Mar.* Men might not be careful to obſerve the other Æquinox, tho' yet it cannot be deny'd, that we have bluſtring weather many times before *Michaelmas*: In Confirmation of all this that I have ſaid, concerning the *Influence* of the

the Winds being conſiderable on the Tides, I ſhall add theſe following Collections of my own out of Hiſtories, Chronicles, *&c.*

1250. *Octob.* 1. (Saith *Holinſhead*) upon the *Change* of the *Moon*, was a moſt dreadful Inundation of the Sea, that did exceeding much Hurt to *Holland*, beyond Sea, *Holland* in *Lincolnſhire*, and the *Marſh-Ground* in *Flanders*, and drowned *Winchelſea*. But he tells us withal, that an unheard of Tempeſt of Wind accompanied it.

1555. *Sept.* 30. (Saith *Stow*) was a notable Inundation of the *Thames*, but he ſaith withal, that it was by Occaſion of a great Wind and Rain that had fallen; the Moon was in *Perigæo*.

15$\frac{62}{63}$. *March* 10. I find this manuſcript Note in Latin in an Ephemerides for that Year, over againſt the Day; *Septentrionis maxima Sævitia* : *Nivis flocci magni*, *ingens*, *frigus*. *Maxime* tumeſcebat æſtus Maris *die & noɛte*, *nam excurrebat in Agros late.*

1592. *Sept.* 6. *Wedneſday*, (ſaith *Stow*) the Wind being Weſt and by South, as it had been for 2 Days before very boiſterous, the *Thames* was made ſo void of Water, by forcing out the freſh, and keeping back the ſalt, that Men in diverſe places might go 200 Paces over, and then fling a Stone to Land, *&c.*

1600. *Decemb.* 8. I find this Note written in another Ephemerides for that Year, over againſt the Day, by an unknown Perſon, who, as it ſeems, was then at *Venice*, (where a South Eaſt Wind makes the higheſt Tides) *Inundatio Venetiis 6. ped. temp. Sirocco.*

1601. (ſaith *Grimſton* in his *Netherland Hiſtory*) the Sea being forced in by a ſtrong *N. W.* Wind, did ſome Miſchief to *Oſtend*.

1601. *Octob.* 26. *St. n.* a great Tempeſt, ſaith the ſame Author, and the Wind *W. N. W.* and the Tide much higher than uſual at *Oſtend*.

1602, *Feb.* 23, 24. *ſt. n.* Blew a terrible North Weſt Wind, which made the Water riſe higher than uſual at *Oſtend*. *Idem.*

1604 *March.* 1. *n. ſt.* The Wind was very great at *Weſt* and *North Weſt*, with a furious Tempeſt, the Tide at *Oſtend* riſing ſo high, as it had not done in Forty Years before. *idem.*

The *Perigæoſis* of the Moon alſo ſeems to have, at leaſt, ſome Influence on the *Tides*, and to make them ſwell higher than elſe they would do. For I have found by obſerving the Tides, as often as I had leiſure, ſeveral high Tides and *Inundations*, tho' I muſt not ſay all, to happen upon the Moon's being in, or very near her *Perigæum*. For Example.

That famous Inundation mentioned before out of *Holinſhead*, 1250, *Oct.* 1. was when the Moon was in *Perigæo*, as appears by Calculation.

1530. *Nov.* 5. That Inundation on which was made the Diſtick,

Anno ter deno poſt ſequimille, Novembris
Quinta, ſtat ſalſis Zelandia *tota ſub Undis.*

Was, when the Moon was in Perigæo.

Jan. 13. 155$\frac{1}{2}$. The *Sea*, ſaith *Michell* in his Chronicle, brake in at *Sandwich*; and overflowed all the *Marſhes* thereabout, and drowned much Cattle, the Moon in Perigæo.

1570. *Nov.* 1. Was a dreadful Flood at *Antwerp*, and on all the Coaſts of *Holland*, that made infinite Spoil; the Moon in Perigæo.

1600. *Dec.* 8. Above mentioned; the Moon in Perigæo.

160$\frac{6}{7}$, *Jan.* 20. Was a great *Inundation* in *Severne*, mentioned in *How*'s Chronicle; that did much Hurt in *Somerſetſhire* and *Glouceſterſhire*, &c. the Moon in Perigæo.

1643. *Jan.* 23. *ſt. n.* ſaith a little *Low-Dutch* Chronicle that I have, was a terrible High-water Flood in *Frieſland*, &c. whereby much Hurt was done to the *Dykes*; and at *Gaes* by *Haerlingen*, the dead Bodies ſtreamed out of the *Earth*; the Moon in Perigæo.

1651. *Feb.* 23. *ſt. n.* (ſaith the ſame Chronicle) was St. *Peter*'s high Flood, whereby much Hurt was done to the Dykes in *Frieſland*, *Embderland*, and elſewhere, and not far from *Dockum*, by *Oudt-woudumer Ziil*, is a Breach of 42 Roods long, broken in the Dyke, the Moon in Perigæo.

Aug. 2. 1657. *ſt. v.* At *Feverſham*, where I then lived, was a very high Spring Tide; and yet the Wind was at South Eaſt, which deads the Tides there; the Moon in Perigæo.

Aug. 22. 1658. *ſt. v.* At *Feverſham* was a very high Tide in the Afternoon, tho' the Wind was Southerly, and blew very ſtiff, which the Seamen there wondred at; the Moon in Perigæo.

1661. Upon *Michaelmas* Day was a great overflowing of the *Severne*, that it drowned the lower Ground lying by it; I lived then in *Glouceſterſhire*, and immediately as ſoon as I heard of it, I noted it down in my *Memorandums*; the Moon in Perigæo.

The Scheme of the *Weather* printed in the *Hiſtory of the* R. S. tells us, that *May* 24, 1663, was a very great Tide at *London*. But it tells us withal that the ſame day the Moon was in Perigæo.

Sept. 19 1669. Here at *Weymouth*, I obſerved my ſelf a very high Tide; and ſo did ſeveral Seamen in that Town, who wondred at it, the Weather being very calm, and that little Wind that was, being at North-Eaſt, which uſes to contribute nothing at all to the Tides in that *Haven*; the Moon in Perigæo.

Further, that which inclines me to believe that the Perigæoſis of the *Moon* is of ſome Concernment in this matter, is, becauſe it is a *maxim* amongſt our *Kentiſh Seaman*, that they never have two running Spring Tides (as they call them) together, but that the next Spring-tide, after a high running Spring, is proportionably weak and ſlack, which if true, is very correſpondent to my opinion, becauſe if the *Moon* be in *Perigæo* at this *Spring-tide*, ſhe will be in *Apogæo* at the next. Accordingly I have received this Account at *Weymouth*, that this preſent *Feb.* 16$\frac{69}{70}$, the Spring Tides ran very high after the *Change*, though the Weather was pretty calm, and that Wind that was not very favourable to the Tides, and that the Spring-tides after the Full, were very low and weak, which is exactly according to my Conjecture.

But I conceive that the beſt *Touch-ſtone* to prove the Soundneſs of my Opinion (which I confeſs I never had the opportunity to do yet) is to have it obſerv'd, whether thoſe Neap Tides be not apparently higher, *conſideratis conſiderandis*, that happen at the Moon's being in *Perigæo* either at the Firſt or Laſt Quarter: Becauſe it is a received and demonſtrable Truth in *Aſtronomy*, that the Moon being in *Perigæo* at either Quarter, comes then nearer the Earth, than when it is in *Perigæo* at the Change or Full.

5. That the *Winds* have a great Influence on the Tides of particular Coaſts and Havens, I do not at all queſtion; and the like I ſay of *Land Waters* which are as to inland Rivers, very conſiderable; eſpecially as to Inundations upon riſing of the Water: For that the Tide and Land Flood ſhould jointly make a greater Inundation than either ſingly would have done, is not to be doubted. But in my Eſſay I take no Notice of theſe, becauſe my Buſineſs was to give a ſtatical Account of ſtated Periods, *Diurnal*, *Menſtrual*, *Annual*, ariſing from regular Motions, not of accidental Extravagancies, ſuch as theſe are.

Anſwered by *Dr.* Wallis, *ib.* p. 2068.

The *Moon*'s *Perigæoſis* alſo is far from being contrary to my *Hypotheſis*: But foraſmuch as it doth not ſtill fall out at the ſame time of the *Day*, *Month*, or *Year*, I could not make it a component of any of thoſe noted Periods *Diurnal*, *Menſtrual*, or *Annual*; and of more Periods than theſe, I did not know that there hath been any general notice taken, of which I might think my ſelf obliged to give an Acconnt: But it may very well influence any or all thoſe, according as it falls out advantageous or diſadvantageous for them.

And as I do ſo readily concur with him in all the particulars by him ſuggeſted; ſo I think he will not be difficult in aſſenting to all the Materials of my *Hypotheſis*. The account which I give of the *Diurnal* and *Menſtrual* Periods, from the common Center of the Gravity of the Earth and Moon, he he doth allow as very rational, and conſequently, which is the Foundation of it, that any *Acceleration* or *Retardation* of the compound Motion of the particular parts in the Earths Surface, is to give ſuch an *Accumulation* of Waters as cauſeth a Tide; and the Complication of ſuch *Accelerations* and *Retardations* concurring or interfering one with another, doth occaſion the perplex Varieties in them.

If therefore there be no other Periods of Tides but theſe, or no other remarkable, my work is done, and I need not be further ſollicitous: For then there will ſeem to be either no other Inequality of *Motions*, or none conſiderable. But, if there be alſo obſervable an *Annual* Period, (as perhaps there may be) then are we to ſeek for the Cauſe thereof in ſomewhat of Inequality, which doth (for the *Annual* Period, annually recur; or for any other Period) which doth recur in ſuch a time as that other Period doth require.

'Tis true, I have not inſiſted on the *Moon*'s Apogæum and Perigæum, with the inequality of *Motion* depending on it; or the *Obliquity* of its *Orb*, which cauſeth another inequality both in the Motion of *Longitude* and *Right Aſcenſion*, becauſe I did not know of any Periodical Viciſſitude of Tides conſonant thereunto. When any ſuch ſhall be diſcovered, we have here a Foundation ready for the ſalving of it. And I the rather think they may be conſiderable; becauſe the *Earth* and *Moon's Appropinquation* and *Elongation*, doth really alter the Diſtance of the common Center of Gravity, of the *Earth* and *Moon*, from the Earth, rendring the Earth's Epicycle Elliptical; and much Favours what Mr. *Childrey* obſerves of the Moon in Perigæo. But as to any Annual Viciſſitude, it is not of uſe, becauſe it doth not annually recur.

But if the annual *High Tides* be at the *Æquinoxes*, not at the times I have aſſign'd, then ſo much of the *Hypotheſis* as concerns the *Excentricity* may be ſpared (or allowed to be ſo little as not to be remarkable) and that of the *Obliquity* alone will give a ſufficient account of it. Or if (to which he ſeems rather to incline) there be no ſuch annual Viciſſitudes at all; then may that of the *Obliquity* be ſpared alſo; and yet the *Hypotheſis* be perfect without it. And till ſome ſuch be obſerved and acknowledged, it will be ſufficient to ſay, That tho' both the *Excentricity* and *Obliquity* do cauſe ſome Inequality in the Motion, yet ſo little, as that in the Tides it is not remarkable, they falling juſt as if the three Motions, (Annual, Menſtrual, Diurnal,) were all exactly circular, and on parallel Axes.

But as to matter of Fact in *Rumney-marſh*, I ſay, that according to the beſt account I can there get, and the unanimous conſent as well of Fiſher-men, and other Water-men, as of other Inhabitants it is conſtant, hardly miſſing (or very ſeldom) any one Year, be the Weather fair or foul: and as well about *Candlemas*, as about *Allhallontide*, every Year, tho' not then ſo High. Of which, tho' they do not pretend to give any Reaſon of it, I think a Cauſe may be very rationally aſſigned. For if you conſult the Tables of the *Inequality of natural Days*, which Parallel I make uſe of for the Explication of this, you will find, that about one of the extreams, in *Jan.* the Increaſe and Decreaſe of the Natural Days fluctuates very much; ſometime increaſing, ſometime decreaſing, according as this or that of the two Cauſes, thwarting one another, doth prevail: But about the other extream, in *October*, it is much otherwiſe; the Increaſings and Decreaſings going on in a continual courſe for a long time together. And the ſame Cauſes applied to the buſineſs of *Tides*, may very rationally be ſuppoſed to produce as unequal Effects. And tho' the Seamen at *Weymouth* have not obſerv'd any ſuch ſignal Effects about *Allhallontide* and *Candlemas*, yet thoſe about *Chepſtow* obſerve the like to happen about the Beginning of *Mar.* and End of *Sept.* the one as much before the Vernal, as the other is after the Autumnal Æquinox, like as in our Caſe it happens, which they call by the Name of St. *Davids Stream*, and *Michaelmas Stream*; as we do thoſe in *Kent*, *Candlemas Stream*, and *Allhallon Stream*. Of theſe different Seaſons at *Chepſtow bridge*, from thoſe of *Rumney-marſh*, I have already given my Remarks. But ſince it is not yet (it ſeems) agreed, Whether ſuch an annual *Phænomenon* happen; or, if ſo, not at that time; ſo that for ought yet appears, it may be at the Seaſons I deſign, that is, between the *Winter Solſtice*, and the two *Æquinoxes* on either ſide of it, though, on ſeveral Coaſts ſeverally remote, I think it beſt to let this part of the *Hypotheſis* ſtand as it is unrevoked, as that which when it ſhall be diſcovered, and agreed on, ſtands ready enough to give a Rational Account of it, and, in the mean time, does no hurt. And in ſuch a Complication of Cauſes ſo Abſtruſe, ſcarce any thing but Obſervation will determine, which of the Cauſes, and in what degree, is to be judged predominate.

VI. The ſole Principle upon which Mr. *Newton* proceeds to Explain moſt of the great and ſurpriſing Appearances of Nature, is no other than that of Gravity, whereby in the Earth all Bodies have a Tendency towards it's Center; and there is the like Gravitation towards the Center of the Sun, Moon, and all the Planets.

Mr. Newton's Theory *of the* Tides *Explain'd by* Mr Halley. n 226. p 445.

Now this Force of Deſcent Decreaſes, as the Square of the Diſtance of the Heavy Body from the Center Increaſes.

There is alſo Room to ſuſpect, that the Force of Gravity is, in the *Celeſtial Globes*, proportional to the Quantity of Matter in each of them.

From theſe Principles it is evident, that if the *Earth* were alone, that is to ſay, not affected by the Actions of the Sun and Moon, the Ocean being equally preſſed by the Force of *Gravity*, towards the Center, would continue in a perfect *Stagnation*, always at the ſame Height, without either *Ebbing* or *Flowing*; But the Sun and Moon having a like Principle of *Gravitation* towards their Centers, and the *Earth* being within the *Activity* of their *Attractions*, it will plainly follow, that the Equality of the Preſſure of *Gravity* towards the Center will thereby be diſturbed; and though the ſmallneſs of theſe Forces, in reſpect of the *Gravitation* towards the *Earth*'s *Center*, renders them altogether imperceptible by any Experiments we can deviſe, yet the Ocean being Fluid and yielding to the leaſt Force, by its Riſing ſhews where it is leſs Preſs'd, and where it is moſt Preſs'd by it's *Sinking*.

p. 445.

Now if we ſuppoſe the Force of the *Moon's Attraction* to Decreaſe, as the Square of the *Diſtance* from its *Center* Increaſes (as in the *Earth* and other *Celeſtial Bodies*) we ſhall find, that where the Moon is perpendicularly either above or below the *Horizon*, either in *Zenith* or *Nadir*, there the Force of *Gravity* is moſt of all diminiſhed, and conſequently that there the Ocean muſt neceſſarily Swell by the coming in of the Water from thoſe parts where the preſſure is greateſt, *viz.* in thoſe places where the Moon is near the *Horizon*. Thus let M be the Moon, E the Earth, C it's Center, and Z the place where the Moon is in the *Zenith*, N where in the *Nadir*. Then by the *Hypotheſis* it is evident, that the Water in Z, being nearer, is more drawn by the Moon, than the Center of the Earth C, and that again more than the Water in N, wherefore the Water in Z, has a Tendency towards the Moon, contrary to that of *Gravity*, being equal to the Exceſs of the *Gravitation* in Z, above that in C: And in the other Caſe, the Water in N, tending leſs towards the Moon than the Center C, will be leſs Preſſed, by as much as is the Difference of the *Gravitations* towards the Moon in C and N. This rightly underſtood, it follows plainly, that the *Sea*, which otherwiſe would be *Spherical*, upon the Preſſure of the Moon, muſt form it ſelf into a *Spheroidal* or *Oval* Figure, whoſe longeſt Diameter is where the Moon is Vertical, and ſhorteſt where ſhe is in the *Horizon*; and that the Moon ſhifting her Poſition as ſhe turns round the Earth once a Day, this *Oval* of

Fig. 56.

Water ſhifts with her, occaſioning thereby the two Floods and Ebbs obſervable in each 25 *Hours*.

And this may ſuffice, as to the general Cauſe of the *Tides*; it remains now to ſhew how naturally this Motion accounts for all the Particulars that has been obſerv'd about them; ſo that there can be no Room left to doubt, but that this is the true Cauſe thereof.

The *Spring Tides* upon the New and Full Moons, and *Neap-Tides* on the Quarters, are occaſioned by the attractive Force of the Sun in the New and Full Conſpiring with the Attraction of the Moon, and producing a *Tide* by their united Forces: Whereas in the Quarters, the Sun Raiſes the Water where the Moon depreſſes it, and the contrary; ſo as the *Tides* are made only by the Difference of their Attractions. That the Force of the Sun is no greater in this Caſe, proceeds from the very ſmall Proportion the Semidiameter of the Earth bears to the vaſt diſtance of the Sun.

It is alſo obſerv'd, that *cæteris paribus*, the *Æquinoctial Spring-Tides* in *March* and *Sept.* or near them, are the Higheſt, and the *Neap-Tides* the Loweſt; which proceeds from the greater Agitation of the Waters, when the Fluid *Sphæroid* revolves about a *Great Circle* of the *Earth*, than when it turns about in a Leſſer Circle, it being plain, that if the Moon were conſtituted in the *Pole* and their ſtood, that the *Sphæroid* would have a fixt Poſition, and that it would be always High Water under the *Poles*, and Low Water every where under the *Æquinoctial*: And therefore the nearer the Moon approaches the *Poles*, the leſs is the Agitation of the Ocean, which is of all the greateſt, when the Moon is in the *Æquinoctial*, or fartheſt diſtant from the *Poles*. Whence the Sun and Moon, being either conjoyned or oppoſite in the *Æquinoctial*, produces the greateſt *Spring-Tides*; and the ſubſequent *Neap-Tides*, being produced by the Tropical Moon in the Quarters, are always the leaſt *Tides*, whereas in *June* and *Decem.* the Spring-Tides are made by the Tropical Sun and Moon, and therefore leſs Vigorous, and the *Neap-Tides* by the *Æquinoctial* Moon which therefore are the Stronger. Hence it happens, that the Difference between the Spring and *Neap Tides* in theſe Months is much leſs conſiderable, than in *March* and *September*. And the Reaſon why the very Higheſt Spring *Tides* are found to be rather before the *Vernal* and after the *Autumnal Æquinox*, *viz.* in *Feb.* and *Oct.* than perciſely upon them, is, becauſe the Sun is nearer the *Earth* in the Winter Months, and ſo comes to have a greater Effect in producing the *Tides*.

Hitherto we have conſidered ſuch Affections of the *Tides* as are Univerſal, without Relation to particular Caſes, what follows from the Differin
Fig. 57. Latitudes of Places, will be eaſily underſtood by the following Figure.

Let *A p E P*, be the *Earth*, cover'd over with very deep Waters. *C*, i *Center*, *P p* its *Poles*, *A E* the *Æquinoctial*, *F f* the *Parallel* of *Latitude* of Place, *D d* another *Parallel* at equal Diſtance on the other ſide of the *Æq noctial*, *H h* the two points where the Moon is *Vertical*, and let *K k* be t great Circle wherein the Moon appears *Horizontal*. It is evident, tha *Sphæroid* deſcribed upon *H h*, and *K k* ſhall nearly Repreſent the Figure of t *Sea*, and *C f*, *C D*, *C F*, *C d*, ſhall be the *Heights* of the *Sea* in the places, *D*, *F*, *d*, in all which it is High-Water: And ſeeing that in 12 Hours time, by the Diurnal Rotation of the Earth, the Point *F*, is transferred to *f*, and *d*, to *D*: The Height of the Sea *C F*, will be that of the High-Water when the Moon is Preſent, and *C F*, that of the other High-Water when the Moon is under the Earth: Which in the Caſe of this Figure is leſs than the former *C F*.

And in the Oppoſite Parallel *D d*, the contrary happens. The Riſing of the Water being always alternately Greater and Leſs in each place, when it is produced by the Moon Declining ſenſibly from the *Æquinoctial*: that being the greateſt of the two High-Waters in each Diurnal Revolution of the Moon, wherein ſhe approaches neareſt either to the *Zenith* or *Nadir* of the Place: Whence it is, that the Moon in the *Northern* Signs, in this part of the World, makes the greateſt *Tides* when above the Earth, and in the *Southern* Signs, when under the Earth; the Effect being always the greateſt where the Moon is fartheſt from the *Horizon*, either above or below it. And this alternate Increaſe and Decreaſe of the *Tides* has been obſerv'd to hold true on the Coaſt of *England*, at *Briſtol* by Capt. *Sturmy*, and at *Plymouth* by Mr. *Colepreſs*.

But the Motions hitherto mentioned are ſomewhat altered by the Libration of the Water, whereby though the Action of the *Luminaries* ſhould ceaſe, the *Flux* and *Reflux* of the Sea would for ſome time continue. This Conſervation of the impreſſed Motion diminiſhes the Differences that otherwiſe would be between two Conſequent *Tides*, and is the Reaſon why the higheſt *Spring Tides* are not preciſely on the New and Full Moons, nor the *Neaps* on the Quarters; but generally they are the *Third Tides*, after them, and ſometimes later.

All theſe things would regularly come to paſs, if the whole Earth were covered with Sea very deep: But by Reaſon of the Shoalneſs of ſome Places, and the narrowneſs of the *Streights*, by which the *Tides* are in many Caſes Propagated, there ariſes a great diverſity in the effect, and not to be accounted for, without an exact Knowledge of all the Circumſtances of the Places, as of the Poſition of the Land, and the Breadth and Depth of the Channels by which the *Tide* flows, for a very Slow and Imperceptible Motion of the whole Body of the Water, where it is, for Example, 2 Miles deep, will ſuffice to raiſe its Surface 10 or 12 Feet in a *Tides* time; whereas, if the ſame Quantity of Water were to be conveyed upon a Channel of 40 Fathoms deep, it would require a very great Stream to effect it, in ſo large Inlets as are the *Channel* of *England* and the *German Ocean*; whence the *Tide* is found to ſet ſtrongeſt in thoſe Places where the Sea grows narroweſt, the ſame Quantity of Water being to paſs through a ſmaller Paſſage: This is moſt evident in the Streights, between *Portland* and *Cape de Hague* in *Normandy*, where the *Tide* runs like a Sluce, and would be yet more between *Dover* and *Calais*, if the *Tide* coming about the Iſland from the North did not Check it. And this Force being once Impreſſed upon the Water, continues to carry it above the Level of the ordinary Height in the *Ocean*, particularly where the Water meets a direct Obſtacle, as it is at

St *Malo*'s; and where it enters into a long Channel, which running far into the Land, grows very ſtreight at its Extremity, as it is in the *Severn Sea* at *Chepſtow* and *Briſtol*.

This Shoalneſs of the Sea, and the Intercurrent Continents are the Reaſon, that in the open Ocean the time of High-Water is not at the Moon's Appulſe to the Meridian, but always ſome Hours after it; as it is obſerved upon all the *Weſt Coaſt* of *Europe* and *Africa*, from *Ireland* to the *Cape of Good Hope*: In all which, a *S. W.* Moon makes High-Water, and the ſame is reported to be on the *Weſt ſide* of *America*. But it would be endleſs to account all the particular Solutions, which are eaſie *Corollaries* of this *Hypotheſis*; as why the *Lakes* ſuch as the *Caſpian Sea*, and *Mediterranean Seas*, ſuch as the *Black Sea*, the *Streights*, and *Baltick*, have no ſenſible *Tides*: For *Lakes* having on communication with the *Ocean*, can neither Increaſe or Diminiſh their *Water*, whereby to Riſe and Fall; and *Seas* that communicate by ſuch Narrow Inlets, and are of ſo immenſe an extent, cannot in a few Hours time receive or empty *Water* enough to Raiſe or Sink their Surface any thing ſenſibly.

Vid. inf. § XI. Laſtly, The cauſe of thoſe Extraordinary *Tides* in the Port of *Tunkin* in *China*, is propoſed by Mr. *Newton* to be from the Concurrence of two *Tides*; the one propagated in ſix Hours, out of the great *South-Sea*, along the Coaſt of *China*; the other out of the *Indian-Sea*, from between the Iſlands in 12 Hours, along the Coaſt of *Malacca* and *Cambodia*. The one of theſe *Tides* being produced in *North* Latitude, is, as has been ſaid, Greater, when the Moon being to the *North* of the *Æquator*, is above the Earth, and leſs when ſhe is under the Earth; the other of them, which is propagated from the *Indian-Sea*, being raiſed in *South* Latitude, is greater when the Moon declining to the *South*, is above the Earth, and leſs when ſhe is under the Earth. So that of theſe *Tides* alternately Greater and Leſſer, there comes always ſucceſſively two of the Greater, and two of the Leſſer together every Day; and the High-Water falls always between the times of the Arrival of the two greater Floods; and the Low-Water between the Arrival of the two leſſer Floods. And the Moon coming to the *Æquinoctial*, and the alternate Floods becoming Equal, the *Tide* Ceaſes, and the Water Stagnates: But when ſhe has paſſed to the other ſide of the *Æquator*, thoſe Floods which in the former Order were the Leaſt, now becoming the Greateſt, that that before was the time of High-Water now becomes the Low-Water, and the Converſe. So that the whole Appearance of theſe ſtrange *Tides*, is without any forcing Naturally deduced from theſe Principles.

Under-Currents *in the* Downs, *at the* Streights Mouth, *and in the* Baltick; *By Dr.* Tho. Smith. n. 153 p. 564

VII. 1. In the *Offing* between the *North-foreland* and *South-foreland*, it run *Tide* and *Half Tide*, that is, it is either Ebbing Water or Flood upon the Shore, in that part of the *Downs*, three Hours, (which is, groſly ſpeaking, the time of half a *Tide*) before it is ſo off at Sea. And it is a moſt certain Obſervation, that where it flows *Tide* and half *Tide*, tho' the *Tide* of Flood runs aloft, yet the *Tide* of Ebb runs under Foot, that is, cloſe by the Ground; and ſo at the *Tide* of Ebb, it will flow under Foot.

There is a vaſt Draught of Water poured continually out of the *Atlantick* into the *Mediterranean*, the Mouth or entrance of which between *Cape Spartel* of *Spain*, as the *Seamen* call it; and *Cape Trafalgar* may be near 7 *Leagues* wide; the *Current* ſetting ſtrong into it, and not loſing its force till it runs as far as *Malaga*, which is about 20 Leagues within the *Streights*. By the Benefit of this *Current*, tho' the Wind be contrary, if it does not overflow, Ships eaſily turn into the *Gut*, as they term the narrow Paſſage, which is about 20 Miles in length. At the end of which are two Towns, *Gibraltar* on the Coaſt of *Spain*, which gives denomination to the *Streights*, and *Ceuta* on the *Barbary* Coaſt: At which places *Hercules* is ſuppoſed to have ſet up his *Pillars*. What becomes of this great Quantity of Water poured in this way, and of that which runs from the *Euxine* into to the *Boſphorus* and *Propontis*, and is carried at laſt thro' the *Helleſpont* into the *Ægean* or *Archipelago*, is a curious Speculation, and has exerciſed the Wit and Underſtanding of Philoſophers and Navigators. For there is no ſenſible Riſing of the Water all along the *Barbary* Coaſt even down to *Alexandria*, the Land beyond *Tripoli*, and that of *Egypt* lying very low, and eaſily overflowable. They obſerve indeed that the *Water* riſes 3 Feet, or 3 Feet and half, in the *Gulf* of *Venice*, and as much or very near as much, all along the *Riviera* of *Genoua*, as far as the River *Arno*: But this rather adds to the wonder.

My Conjecture is, that there is an *Under-Current*, whereby as great a quantity of water is carried out, as comes flowing in. To confirm which, beſides what I have ſaid above about the difference of *Tides* in the *Offing*, and at the Shore in the *Downs*, which neceſſarily ſuppoſes an under Current, I ſhall preſent you with an Inſtance of the like Nature in the *Baltick Sound*, as I received it from an able *Seaman*, who was at the making of the Trial.

3. He told me, that being there in one of the King's *Frigats*, they went with their *Pinnance* into the middle Stream, and were carried violently by the *Current*: That ſoon after they ſunk a Bucket with a large *Cannon Bullet* to a certain depth of Water, which gave Check to the Boat's Motion; and ſinking it ſtill lower and lower, the *Boat* was driven a-head to the windwards againſt the upper Current; the Current aloft, as he added, not being above 4 or 5 Fathom deep, and that the lower the Bucket was let fall, they found the under Current the ſtronger.

The irregular Flux and Reflux of the Euripus, *by* F. Jacq. Paul Babin, n. 71 p. 2153.

VIII. The *Euripus* is a Streight of the *Ægean Sea*, ſo narrow that a *Galley* can ſcarce paſs thro' it under a Bridge, built between the *Citadel* and the *Donjon* of *Negropont*. But not only this place, where the Bridge is, is call'd the *Euripus*, but alſo 10 or 12 Leagues on each ſide of it, where the *Channel* being more large, the inconſtant Courſe is not ſo ſenſible, as at the Foot of the *Caſtle*. For 3 or 4 Leagues on each ſide there are found 6 or 7 Gulfs, wherein this *Water* ſhuts it ſelf up, to iſſue from thence as often as it enters there; and the Situation of theſe Gulfs contributes to the Oddneſs of this Flux and Reflux, of which the Moon ſeems to be the principal Cauſe.

There are 20 days of each Moon, in which the courſe of the *Euripus* is regular, and 10 in which it is irregular; that is to ſay, 5 Days before, and 5 Days after the *New* and *Full-moon*, the courſe of it is regular and ſtrong: And then you ſee there the like *Phænomena* with thoſe of the *Ocean* at *Bourdeaux*;

deaux. The Sea hath 2 Fluxes and Refluxes in 24 Hours, and every Day it retardeth almoſt an Hour. But there are 9 or 10 *Changes* of the *Courſe* of the Water during the remaining 10 Days of *Inequality*, unleſs it blow hard, for then the Courſe changeth not above 6 or 7 times. I once ſtayed on the *Mill* which is under the Bridge, 1 ½ hour, and I ſaw the Courſe of the Water change thrice, though the Wind was pretty high, and the Wheels of the Mill turned as often divers ways. *M. de la Hogue*, a *Pariſian* Gentleman, being curious, ſtaid there almoſt a whole Day with a *Janizary*; and the *Moon* being near the *Full*, he obſerved the ſame thing that happens in the *Ocean*. But tho he deſigned to ſtay there full 24 Hours during the irregular Days, he was diſſwaded from it for Fear of the *Turks*, that might take him for a Spy, and do him ſome Miſchief.

The Water riſeth not much above a Foot; and when it riſeth, it runs into the Sea, and when it ſinks, it flows into the *Channel*, going towards *Conſtantinople*.

The ſmall *Gulfs* that are on the left ſide of the Port of *Negropont*, are fill'd when the Water riſeth; and emptied, running towards *Theſſalonica* or *Conſtantinople*, when it deſcends. *F. Vabois* took notice of the ſame at *Conſtantinople*, *viz.* That the Waters of the *Black Sea* that come from *Conſtantinople*, drive the *Euripus* in its riſing towards the main Sea, and that thereafter the Waters retire themſelves towards the ſame place again from whence they came. The ſame Perſon alſo obſerved, That the ſwelling of the *Euripus*, which is irregular, laſted not above a good Quarter of an hour, and the ſinking thereof three good Quarters, tho' then the Water ran with more Rapidity, and ſeemed to us to come away in thrice as great plenty, than when he ſaw it riſe. I know not whether this proceeded from the Wind, not being able to aſſure you, that this Effect is ordinary.

Between the Aſcent and Deſcent there is a little Interval, wherein the Water ſeems to be at reſt and ſtagnating, ſo that if there be no Wind ſtirring it, bits of Wood and Straw lie ſtill upon the Water without Motion.

From what I have ſaid, 'tis not difficult to reconcile the *Authors* that have written ſo differently of the *Euripus*. For thoſe that have ſaid, that there is nothing in it but what is ſeen in the *Ocean*, that is, two Fluxes and Refluxes in 24 Hours, have only obſerved it in thoſe 20 Days of its Regularity. And the Ancients have not delivered a Falſhood, when they ſay that there are 7 *Reciprocations* in one Day, becauſe that happens when the Winds trouble and retard the Courſe of the Water: And I do aſſure, by often reiterated Obſervations, that when 'tis ſtill *Weather*, the Flux and Reflux is made even to 9 or 10 Times in a natural Day.

Extraordinary *Tides about the* Orkneys, *communicated by Sir* Rob. Moray, [illegible] p. 6139

IX. In *Fairay-Sound*, betwixt the Iſles of *Fairay* and *Aetha* in *Orkney*, the Sea runneth North Eaſt, for the ſpace only of 3 Hours in flowing, and 9 Hours South-weſt in Ebbing. This is the Courſe of the Tide only in the middle of the *Sound*, which is but one Mile broad.

Whilſt the Sea runneth from Weſt to Eaſt in flowing thro' *Weſtra Firth*, which is 8 Miles in breadth, there are no greater *Surges*, than in any other place of the Sea; and in a calm Day it is as ſmooth as any Lake, tho' there is conſtantly a great *Current*, in the *Flux* and *Reflux* of the Sea. Yet at the South-eaſt-End of a little Iſland on the *S. E.* ſide of *Weſtra*, and about a Mile from it, the Sea no ſooner begins to run weſtward in ebbing, but there beginneth a *Surge* to appear, which continually encreaſeth until the Ebb be half ſpent, and afterwards it decreaſeth until it be low Water; at which time there appeareth no ſuch thing. Eaſt and Weſt from this great Surge, there are ſome few leſſer *Surges* ſeen, which are gradually leſs toward the Eaſt and Weſt. I having Occaſion to paſs that way in a little Boat, when we had paſſed over the Eaſtmoſt *Surges*, and were beginning to aſcend the biggeſt, upon the 10th of *April*, at one of the Clock in the Afternoon, the *Surge* before us was ſo high, that it intercepted the Sight of the Sun, and ſome *deg.* of the Firmament above it. The *Surge* is about a quarter of a Mile in length. When there is any Wind, which occaſioneth the breaking of the Tops of the *Surges*, there is no paſſing that Way. The Current of the Tide is ſo ſtrong there, that there is no need of Sails or Oars, ſave only to direct the Boat as doth the Helm.

Extraordinary Tides in the Weſt-Iſles of Scotland, By Sir Rob. Moray, n. 4 p. 53.

X. In that Tract of Iſles on the Weſt of *Scotland*, called by the Inhabitants the *Long Iſland*, as being about 100 Miles long from North to South, there is a multitude of ſmall Iſlands ſituated in a Fretum or *Firth*, that paſſes between the Iſland of *Euſt* and *Herris*; amongſt which there is one called *Berneray*, ſome 3 Miles long, and more than a Mile broad, the length running from Eaſt to Weſt, as the *Firth* lies. At the Eaſt-end of this Iſland, where I ſtaid ſome 16 or 17 Days, I obſerved a very ſtrange Reciprocation of the *Flux* and *Reflux* of the Sea, and heard of another no leſs remarkable.

Upon the Weſt-ſide of the *Long Iſland*, the *Tides* which came from the S. W. run along the Coaſt Northward; ſo that during the ordinary Courſe of the *Tides*, the *Flood* runs Eaſt in the *Firth*, where *Berneray* lies, and the *Ebb* Weſt. And thus the Sea ebbs and flows orderly, ſome 4 Days before the *Full Moon*, and *Change*, and as long after the ordinary *Spring-Tides* riſing ſome 14 or 15 Foot upright, and all the reſt proportionably, as in other places, But afterwards, ſome 4 Days before the *Quarter Moons*, and as long after, there is conſtantly a great and ſingular *Variation*. For then, (a ſoutherly *Moon* making there the *full Sea*) the *Courſe* of the *Tide* being Eaſtward when it begins to *flow*, which is about $9\frac{1}{2}$ of the Clock, not only continues ſo till about $3\frac{1}{2}$ in the *Afternoon*, that it be *High-water*, but after it begins to ebb, the *Current* runs on ſtill *Eaſtward*, during the whole Ebb, ſo that it runs Eaſtward 12 Hours together, that is, all day long, from about $9\frac{1}{2}$ in the Morning, till about $9\frac{1}{2}$ at Night. But then, when the Night *Tide* begins to flow, the *Current* turns and runs weſtward all Night, during both Flood and Ebb, for ſome 12 Hours more, as it did Eaſtward the Day before. And thus the *Reciprocations* continue, one *Flood* and *Ebb*, running 12 Hours Eaſtward, and other 12 Hours weſtward, till four Days before the *New* and *Full Moon*; and then they reſume their ordinary regular *Courſe* as before, running Eaſt, during the 6 Hours of *Flood*; and Weſt, during the 6 of Ebb. And this I obſerved

ſerved curiouſly, during my Abode upon the place, which was in the Month of *Auguſt*, as I remember.

But the Gentleman, to whom the *Iſland* belongs at preſent, and divers of his Brothers and Friends, knowing and diſcreet perſons, and expert in all ſuch parts of Sea-matters, did aſſure me, that whereas between the *Vernal* and *Autumnal Æquinoxes*, that is, for 6 Months together, the Courſe of *irregular Tides* about the Quarter-moons, is to run all Day, that is 12 Hours, as from about $9\frac{1}{2}$ to $9\frac{1}{2}$, $10\frac{1}{4}$ to $10\frac{1}{4}$, *&c.* Eaſtward, and all Night, that is 12 Hours more weſtward, during the other 6 Months, from the Autumnal to the Vernal Æquinox, the Current runs all Day weſtward, and all Night Eaſtward.

At Tunqueen, *by* Mr. Fr. Davenport, n. 162. p. 667.

XI. 1. During my Stay at *Batſha*, having (without intermiſſion) obſerv'd the daily Courſe of the Tides, my Advice is, that upon the ſeveral following Days of the Moon's Age in every particular Month of the Year, no *Engliſh* Commander ſhould, upon any Occaſion whatſoever adventure over this *Bar*, unleſs he have a Pilot from the Shore, who undertakes to bring him in; or that he hath only Charge of ſome ſmall *Bark* or *Junk*, that draws no more than 8 or 9 Foot Water.

In the $\left.\begin{matrix}1\\7\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}3\\17\end{matrix}\right.$ to the $\left.\begin{matrix}7\\21\end{matrix}\right\}$ days of the *moon's Age excluſively.*

In the $\left.\begin{matrix}2\\8\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}1\\14\end{matrix}\right.$ to the $\left.\begin{matrix}5\\18\end{matrix}\right\}$ days of the *moon's Age excluſively:*

and from the 27 to the 1*ſt* of the $\left.\begin{matrix}3\\9\end{matrix}\right\}$ Moon's *Excluſively.*

In the $\left.\begin{matrix}3\\9\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}11\\25\end{matrix}\right.$ to the $\left.\begin{matrix}15\\29\end{matrix}\right\}$ days of the *moon's Age excluſively.*

In the $\left.\begin{matrix}4\\10\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}9\\23\end{matrix}\right.$ to the $\left.\begin{matrix}13\\27\end{matrix}\right\}$ days of the *moon's Age excluſively.*

In the $\left.\begin{matrix}5\\11\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}7\\21\end{matrix}\right.$ to the $\left.\begin{matrix}11\\25\end{matrix}\right\}$ days of the *moon's Age excluſively.*

In the $\left.\begin{matrix}6\\12\end{matrix}\right\}$ Moons, from the $\left\{\begin{matrix}5\\19\end{matrix}\right.$ to the $\left.\begin{matrix}9\\23\end{matrix}\right\}$ days of the *moon's Age excluſively.*

And excepting on theſe 6 Days above mentioned in every reſpective Moon, he may ſafely adventure over the *Bar* any Day, provided always that he miſtake not the Time of the Tide, but come over at half Flood or better, tho' he may take Notice that the beſt Tides will be about 6 or 7 Days after the Water's firſt beginning to Increaſe, and the firſt Days of the Water's Increaſe are,

In the	1 7	Moons, on the	5 19	days	of the Moon's Age.
In the	2 8	Moons, on the	3 16	days	
In the	3 9	Moons, on the	13 27	days	
In the	4 10	Moons, on the	11 25	days	
In the	5 11	Moons, on the	9 23	days	
In the	6 12	Moons, on the	7 21	days	

The *Bar* it ſelf being about a Mile and a half in length, and no where, except in its firſt Entrance, exceeding half a Mile in Breadth, is very even, but yet affords conſiderably differing Soundings in the ſame Age and Time of the Tides, according to the Seaſon of the Year, and which ſeems to be ſomewhat ſtrange, hath the higheſt Tides in the Northerly *Monſoon*, as I have been inform'd by thoſe who are ſeemingly beſt able to give an account thereof; and I muſt needs ſay, that the Trial I made on the Bar in *July*, 1678, did accord with what I underſtood from ſeveral of the Fiſhermen, and others as to that Month, which induced me to enter this *Information*, that coming over at half Flood, except on the Days aforementioned, as dangerous to come over in, there will be found according to the Age of the *Tides*,

In the	3 4 5	Moons, from 16 to 21 feet Water.
In the	6 7 8	Moons, from 19 to 24 feet;
In the	9 10 11	Moons, from 21 to 27 feet.
In the	12 1 2	Moons, from 17 to 22 feet.

Always the higher the Flood, the lower the Ebb, ſo that according to the Strength of the Tides at *Low-water*, the *Soundings* are from 6 to 13 Feet.

On the firſt and ſecond days at the Water's *Increaſe*, the *Influxes* are very ſmall and uncertain, but afterwards the *Tides* for 13 days are *conſtant* in their *Courſe*, one *Flood*, and one *Ebbing* being compleated in 24 hours time, equally ſharing the ſpace of a *Lunar Circuition* of the Earth between them, and every *Flood* beginning neareſt ¼ of an hour later than the precedent *Flood*, and alſo conſiderably increaſing in the height of the *Tide* every day from the 3*d*. unto the 6*th* and 7*th* days of the *Water*'s Age, on which 2 days the Flood runs very high: but on the 8*th* day (which may be accounted the laſt of the *Spring-tides*) the Waters begin gradually to decreaſe again, retaining the ſame orderly difference of time in each Tide, until the next following firſt day of the Water's *Increaſe*, when during 2 Days Unſetledneſs, there is a Shifting of the *Tides* in reſpect of the beginning of the *Flood* and *Ebb*, after which ſaid ſhifting, a Conſtancy in their inverted Courſe, is again retained in the above mentioned Order for 13 days following; as for Example,

On the 25 and 26 days of the 4*th Moon*, (4*th* and 5*th* of *June* 1678, ☽ in the latter end of *Aries*) being the firſt days of the Waters *Increaſe*, the *Influxes* were very ſmall, there happening on the 26 a falling back of the Tides about 13 hours· But from the 27 (*June* 6. which was the third day of the Water's *Increaſe* after the *Laſt Quarter*, unto the 9 day of the 5*th Moon*'s *Age*, (*June* 18. 1678. ☽ in ♎ 20.) I noted a very conſtant *Courſe* in the Tides, every Flood beginning with the riſing of the *Moon*, and ending at it's ſetting; the following *Ebb* in like manner continuing during the time of the *Moon*'s Abſence from this *Hemiſphere*. But on the ſaid 9*th* day of the 5*th* Moon's Age (*June* 18 1678) being the firſt Day of the Water's *Increaſe*, their motion was ſcarcely perceptible; on the 10 day there was another falling back of the *Tides* neareſt 13 hours, and on the 11*th* day, (which was the 3*d*. day of the Water's *Increaſe*, after the firſt *Quarter* of the Moon's *Age*) the Flood having (as I ſaid) ſhifted the preceeding day, took its turn to begin at the Moon's Setting, and end at its riſing, and accordingly the Tides ſucceſſively following aſſumed and kept a conſtant Regularity, the Tides being at higheſt the 16*th* of the Moon, (1678. *June* 24. ☽ in middle of ♑) which was the 7*th* of the Water's Age, until the 23 of the ſaid Moon's Age (*July* 1. 1678) on which, being the firſt Day of the Water's *Increaſe*, the *Influx* was again ſcarcely diſcernable for its Smallneſs.

N. B. This *Bar* of *Tunking* is about 110 Degrees of *Longitude* to the Eaſt of *London*, and in the *Lat*. 20°. 50′.

On the 24 day the *Tides* fall back, as I had found it twice before to have done on the ſame days of the *Water's Age*, neareſt 13 hours, by which means the *Flood* on the 25 Day, which was the 3*d* day of the *Water's Increaſe* after the laſt *Quarter* of the Moon, now again commenced with the Riſing Moon, whereby it hath fallen out always to be *High-water* between Noon and the following Midnight every day during my Stay here. (☾ *Laſt Quarter* 22 Days, ☾ *Firſt Quarter* 8 Days.)

So that it may paſs into a Corollary, *viz*. In the 4*th*, 5*th* and 6*th Changes* of the Moon from the 3*d*. day of the *Water*'s *Age* after the laſt Quarter, to the 3*d*. day of the *Water*'s *Age* after the firſt Quarter of the following Moon, the Water, begins to flow when the Moon riſeth, and to ebb again when it ſetteth in the Horizon, and the contrary to the third Day of their Age after the laſt Qnarter, excluding always their Motion on the two firſt Days of the *Water's Increaſe*, becauſe of its Smallneſs and Uncertainty.

I am informed by the *Inhabitants* hereabouts, that this may hold for a rule from the 2*d* to the end of the 7*th moon*, and that the Converſe thereof holds true in the other 6 *months* of the Year, *viz.* from the 8*th* to the end of the *firſt moon*: According to which, the *Tides* will fall out to be at the higheſt in the *Evening* for 6 *months* ſucceſſively, and the other half Year in the *morning*; that is to ſay between *midnight* and the following *Noons*. And tho' I cannot averr the truth of it, yet I find that the *Tide* laſt Year in the 11*th moon*, which occaſionally upon the Ship *Eagle*'s departure hence, I took ſome notice of, did fall out not diſagreeing with what they affirm: And I am yet the rather induced to believe that in every annual Revolution, there may be ſuch a Conſtancy in this different Motion of the Tide appropriated to each Moiety of the Year, becauſe that during my —— days Stay at *Batſha*, I have found the Predictions of the Natives confirmed by my own Obſervations of the Tides falling out to be High-water always between *Noon* and the ſucceeding *midnight*, occaſioned by the aforeſaid falling back at the end of 15 days; ſo that on every third day of the *Water*'s *Increaſe*, the Flood begins at the Hour whereon the Day before it ended.

To prevent miſtakes in the accompt of the *moons*, it may be ſufficient to inform thoſe who uſe this port, that the 1*ſt Change* of the *moon* after the 15*th* day of *January*, *O. S.* is reckoned for the beginning of the Year, and that *moon* being accompted the firſt, the reſt follow in order until the expiration of the 12*th* which compleats their Year, except only in their *Leap-Years*, and then they have 13 *moons*, taking in one extraordinary to make up the Deficiency of the *moon's Epact* in their Accompt, in which Years the firſt Day of their *New-year's-moon* falls out before the ſaid 15 day of *January*, as it did this Year 1678 upon the 12 being *Leap-Year* with them, ſo that they reckoned two Months for one this Year, that is to ſay, the 2*d* and 3*d moons*, after their *New-Year*'s *Day*, they called 2*d moons*, for otherwiſe this preſent *moon* which changed in *July* (the 8*th*) would have been the 7*th* whereas now they count it but the 6*th moon*, and accordingly do the Tides fall out. But this Leap-year being paſt, the firſt Moon in the Year muſt be reckoned to begin on the Change next following the 15*th* of *January*, and all the other Changes counted ſucceſſively as before ſaid, until the *Intervention* of another Leap Year.

A Theory of the Tides at Tonqueen, By Mr. Edm. Halley, ib. p. 685.

2. The Effect of the *moon* upon the waters, in the production of the *Tides* in this *Port* of *Tunking*, is the more wonderful and ſurpriſing, in that it ſeems different in all its circumſtances from the general Rule, whereby the *motion* of the *Sea* is regulated in all other part of the *World* I have yet heard of. For firſt, each *Flux* is of about 12 hours duration. and its correſpondent Reflux long; ſo that there is but one *High-water* in 24 hours. Then there are in ch *month* two *Intermiſſions* of the *Tides*, about 14 days aſunder, when there no ſenſible Flood or Riſing of the Waters to be obſerved; but the Sea is a manner ſtagnant. *Thirdly*, that the *Increaſe* of the Water has its 14 ys period between the aforeſaid *Intermiſſions*: And that at 7 Days End akes the *higheſt Tides*, from which time the *Water* again gradually abates, d the Flood is weaker till it comes to a *Stagnation*; both *Increaſe* and *Decreaſe*

obſerving the ſame rule, in being exceeding ſlow in their Beginning and End, and ſwift in the middle. *Laſtly*, and which is moſt odd, the riſing Moon in the one half of each Month, makes high Water, and the Setting Moon in the other half. Thoſe particulars conſider'd together with the Tables, ſhewing the days of the *Water*'s *Stagnation* in each Month, gave me a Light into the ſecret of this ſtrange Appearance, ſo as to be able to bring the hitherto unaccountable irregularity of theſe Tides to a certain Rule.

And 1*ſt*. It appears by the latter of the two Tables, that the *Intermiſſions* of the *Tides* happen nearly upon thoſe days, that the Moon enters the Signs of *Aries* and *Libra*, or paſſes the *Æquinoctial*; which divides the Moon's courſe nearly into 2 equal parts, as well as the *Sun*'s, and from hence it follows that the *Tropical moons* in ♋ and ♑, are thoſe which occaſion the greateſt *Flux* and *Reflux*; and for the Rule of the Change of the time of *High-water*, which Mr. *Davenport* calls a *falling back* of the *Tides*, the Example he hath given us, let us know that the ☾ in *Northern Signs* brings in the Flood, whilſt ſhe is above the *Horizon*, ſo as to make *High-water* at her *Setting*; and on the contrary, that whilſt ſhe is in *ſouthern ſigns*, it flows all the Time the *Moon* is below the Horizon, and ſo make *High-water* at her Riſing. But it is to be obſerved, that tho' the Moon paſs ſwiftly from *South* to *North*, when ſhe is in or near ♈, and from *North* to *South* in or near *Libra*, yet the Motion of the Sea, which is the Cauſe of this *Tide*, is ſcarce diſcernable for 3 or 4 days, when the Moon paſſes the ſaid *Æquinoctial Points*; whence it appears, that tho' the Declination of ☾, or her diſtance from the *Æquinoctial*, be that whereby theſe *Tides* are regulated, yet the *Increaſe* and *Decreaſe* of the Water is by no means proportionable to that of the *Declination* of ☾; that changing ſwiftly where the *Increaſe* of the Water is obſerved to be moſt ſlow. It ſeems therefore, and I propoſe it as a probable Conjecture, that the *Increaſe* of the *Waters* ſhould be always proportionate to the *verſed Sines* of the double diſtances of the *moon* from the *Æquinoctial Points*; upon which *Hypotheſis*, *Fig.* 58. will give an elegant *Synopſis* of the whole matter. Let *A. B* be the bottom of the *Bar* of *Tunking*; *C D*, a Perpendicular thereto, whereon to meaſure the ſeveral depths of the *Water*; *C* ♈, *C* ♎, the mean depth, which is that whereat the *Water* is *ſtagnant* upon the *Moon*'s being upon the *Æquinoctial Points*; being commonly about 15 Feet: *C* ♋ *Occid.* the *High-water Mark*, when the *Moon* is in ♋ or ♑, being about 24 Foot. *C* ♑, *occid.* the height of the *Low-water Mark* when the *Moon* is in ♋ or ♑, being about 6 Foot; ſo that the greateſt Riſe of the *Water* on the *Tropical Moons* will be about 18 Foot; then dividing ♈ ♋, and ♎ ♑, into 2 equal parts, in *E*, *F*, on thoſe 2 points, as *Centers*, deſcribe the two *Circles*, each of whoſe *Radii* are four Feet and a half, which being kept between the Compaſſes, naturally divide the ſaid Circles in the Points, ♉, ♊, ♋, ♌, &c. through the which Points, if you draw Lines Parallel to the *Baſe A B*, they ſhall cut the perpendicular *C D*, in the Heights of the high and low *Water-marks*, which will be at the Entrance of the Moon into the ſaid Signs. So the greateſt Depth of the *High water*, when the Moon enters ♉, ♍, ♌, ♓, is but 17¼ Feet, and the leaſt at *Low-water*, 12¾ Feet: But when ſhe enters ♊, ♌, ♐, ♒, the *High-*

Water depth is $21\frac{1}{4}$ Feet, the *Low Water* is $8\frac{1}{4}$ Feet; as appears by the *Figure.* And this *Hypotheſis* not only agrees with all that Mr. *Davenport* hath obſerved himſelf, or collected from the Natives, but hath been found to hold true ſince in the Year 1682, by the Ingenious Captain *Knox*, in his Voyage to this Port; ſo that there is no room to doubt of the Truth thereof. 1. By this Method may the Time and Height of the *Tides* be with ſufficient Certainty computed: But to Philoſophize thereon, and to attempt to aſſign a Reaſon, why the Moon ſhould in ſo particular a manner Influence the Waters in this one Place, is a Task too hard for my undertaking, eſpecially when I conſider how little we have been able to eſtabliſh a Genuine and Satisfactory *Theory* of the *Tides*, found upon our own Coaſts, of which we have had ſo long Experience.

XII. Mr. *Boyle* having recommended this matter, among others, to a learned Phyſician that was ſailing into *America*, and furniſhed him with a ſmall *Hydroſtatical Inſtrument*, to obſerve from time to time the differences of Gravity he might meet with, This Account was returned him, that he found by the Glaſs, the Sea Water to Increaſe in Weight the nearer he came to the Line, till he arrived at a certain Degree of *Latitude*; as he remembers, it was about the 30*th*, after which the Water ſeemed to retain the ſame *ſpecifick Gravity*, till he came to the *Barbadoes*, or *Jamaica*.

The differing Gravities *of* Sea-Water *according to the Climates*, *By* —— n.18. p.315.

XIII. M. *Hauton* hath now declared his Secret of making Sea-Water ſweet. It conſiſts firſt in Precipitation made with the *Oil* of *Tartar*, which he knows to draw with ſmall Charges. Next, he Diſtills the Sea-Water; in which the Furnace taketh up but little room, and is ſo made, that with a very little Wood or Coal he can Diſtill 24 (*French*) Pots of Water in a Day; for the Cooling of which he hath this new Invention, that inſtead of making the Worm paſs through a Veſſel full of Water (as is the ordinary Practice) he maketh it paſs through one Hole, made on purpoſe out of the Ship, and to enter in again through another: So that the Water of the Sea performeth the Cooling part; by which means he ſaveth the Room, which the common *Refrigerium* would take up; as alſo the Labour of Changing the Water when the Worm hath Heated it. But then Thirdly, he joins to the two precedent Operations Filtration, thereby perfectly to Correct the Malignity of the Water. This Filtration is made by means of a peculiar Earth, which he mixeth and ſtirs with the Diſtilled Water, and at length ſuffers to ſettle at the bottom.

A way to make Sea-Water ſweet; *By Mr.* Hauton, n. 67. p 2048.2050

He maintains, that his Diſtilled *Sea-Water* is altogether ſalubrious. He proveth it firſt from Experience, it having been given to Men and Beaſts, without any ill effect at all upon them. Secondly, From Reaſon, grounded on this, that that peculiar Earth being mixed with the Diſtill'd Water, blunts the Points of the *Volatile Spirits* of the *Salt*, and ſerveth them for Sheaths, if I may ſo ſpeak, taking away their force and *Maligne* ſharpneſs.

XIV. It ſeems Probable to me, that the Sea-Water was the only Element created at the *Beginning*, before any *Animal* or *Vegetable* was created, or the Sun it ſelf. But upon the Creation of theſe, the Freſh Water, had its Riſe Accidentally, becauſe it owes its being in great part (as I have elſewhere ſhewn

Sea-Water *made* Freſh *By Dr.* Mart Liſter, n. 156. p. 493. *De Font. Med.* Angl.

ſhewn) to the Vapours of Plants, and the Breath of Animals; and the Exhalations raiſed by the Sun. Now that the Sea-Water is made Freſh by the Breath of Plants growing in it, I thus demonſtrated: I took a long Glaſs Body, and having fill'd it pretty full with Sea-Water, taken up at *Scarborough*, I put therein common Sea-Weed (*Alga Marina*) freſh and new gathered, ſome with the Roots Naked, and ſome growing on and adhering to Stones: The Glaſs Body being full, I put thereon a *Head* with a *Beek*, and adapted a Receiver thereto, all without any Lute or cloſing the Joints; from theſe Plants did diſtil daily (though in a ſmall Quantity) a Freſh, very Sweet, and Potable Water, which hath no *Empegreuma*, or unpleaſant Taſt, as all thoſe Diſtill'd by Fire neceſſarily have.

This I take to be the moſt Natural, moſt Eaſie, and moſt ſafe way of having Sweet Water from the Sea, and which may be of great uſe, even to ſupply the neceſſity of *Navigators*. And I do not doubt but there may be found other Plants growing in or near the Sea, which would yield Freſh Water in much greater Quantities.

Wells of Freſh Water *near the* Sea *at* Bermudas; *By* Mr. Rich. Norwood, n. 80. p. 566.

XV. We digg Wells of Freſh Water ſometimes within 20 Yards of the Sea, or leſs, which Riſe and Fall upon the Flood and Ebb, as the Sea doth; and ſo do moſt of the Wells in the Country; though further up (as I am inform'd:) Whereſoever they digg Wells here, they dig till they come almoſt to a Level with the Superficies of the Sea, and then they find either Freſh Water or Salt. If it be Freſh, yet if they dig two or three Foot deeper, or often leſs, they come to Salt Water. If it be a Sandy Ground, or a Sandy Crumbling Stone, that the Water ſoaks gently through, they find uſually Freſh Water; but if they be hard *Limeſtone* Rocks, which the Water cannot ſoak through, but paſſeth in Chinks or Clefts between them, the Water is Salt or Brackiſh.

To Examine the Freſhneſs *of* Water, *by* Mr. Boyle, *n.* 197. p. 627.

XVI. 1. When I remembred and conſider'd, that (as I have found by various Trials) diverſe Metalline, and other Mineral Solutions, could be readily *Precipitated*, not only by the *Spirit* of *Salt*, but by *Crude Salt*, whether Dry or Diſſolved in Water, 'twas no very difficult Matter for me to think, that by a heedful application of the *Precipitating* Quality of Common Salt, one might diſcover whether any Particles of it, (at leaſt in a number any way conſiderable) lay concealed in Diſtill'd Water, or any other propos'd to be examin'd. To this end I employ'd ſeveral Drugs, and thoſe not all prepar'd by one *Menſtruum*. And tho' two or three of my other Tryals had Succeſſes, that I diſliked not when I made them, yet that which at length I pitched upon as the moſt certain, and which therefore I meant, when I had the Honour to be ſent for by his Majeſty about the Patentees Water, was that which I think may be beſt underſtood, as well as recommended, by this ſhort Narrative.

I took ſome Common Water diſtill'd in Glaſs Veſſels, that it might leave its Corporeal Salt, if it had any, behind it, and put into a Thouſand Grains of it one Grain of common dry Salt: Into a convenient Quantity, for Example, two or three Spoonfuls, of this thus Impregnated Liquor, I let fall a fit proportion, for Inſtance 4 or 5 drops, of a very ſtrong and well Filtrated So-

lution of well-refined *Silver*, diſſolved in clear *Aqua-fortis*; [for a Shift, common or *Sterling Silver* will ſerve the turn:] And I made the Experiment ſucceed with Spirit of *Nitre*, inſtead of *Aqua-fortis*; upon which there immediately appeared a Whitiſh Cloud, which, though but ſlowly, deſcended to the bottom, and ſettled there in a White *Precipitate*. And to make the Experiment rather ſeverely, than at all favourably, there was uſually taken ſomewhat more than a thouſand parts of Water to one of Salt.

But I obſerved, that having let fall a few Drops of our *Metalline Solution*, into the Liquor obtain'd from Sea Water by the *Patentees* way of Sweetning it, there did not preſently enſue any white Cloud or *Precipitate*, much leſs ſuch an one as had been newly afforded by the Water that was Impregnated with leſs than a thouſandth part of Salt. And if after ſome time there happened to appear (for 'tis not abſolutely neceſſary it ſhould) a little Cloudineſs in this *Factitious Liquor*, it was both ſlowlier produced, and much leſs, than that which appear'd in the Impregnated Water.

Perhaps it may be proper, that I here obſerve (what is not wont to be taken notice of) That divers *Solutions* of *Mineral* Bodies may be *Precipitated* by *Dilution*; that is, (to explain this Expreſſion) when the *Solution* has time enough allowed to diffuſe it ſelf through a great Quantity of Water, the *Saline* parts are thereby ſo *Diluted* and Weakned that they are no Longer able to ſuſtain the *Mineral Corpuſcles*, they kept ſwimming before, but make with them, and the Water, a confuſed and ſubſiding Mixture; uſually of a Whitiſh Colour. This may appear when the *Butter* of *Antimony*, being put into *Common-Water*, is thereby quickly and plentifully *Precipitated* in the form of that White Powder, that *Chymiſts* (not over-deſervedly) call *Mercurius Vitæ*. To which I may add, that I have alſo produc'd a Powder of that Colour, by pouring into *common Water* a ſtrong *Solution* of *Tin Glaſs* made in *Aqua-fortis*. And by the ſame way we have *Precipitated* the *Tincture* (or *Solutions* of the finer parts) of *Jalap*, *Benjamin*, true *Labdanum*, *Antimonial Sulphur*, and divers other Bodies, made in *Vinous Spirits*. If it were not for this Power, that *Water* has to weaken moſt *Solutions* of Bodies, I could have employed inſtead of that *Silver*, either *Quick-ſilver* diſſolved in *Aqua-fortis*, or *Lead* Crude or Calcin'd, in the ſame Liquor, or (which is more convenient) in ſtrong *Spirit* of *Vinegar*; ſince theſe, and ſome others, are found to be *Precipitable* by *Salt Water* into Whitiſh Powders. But tho', a very heedful obſerver may for a ſhift, make uſe of theſe *Metalline Solutions*, to gueſs at the Quality of *Water*, as to *Freſhneſs* and *Saltneſs*; yet the *Precipitation* that is made by *Dilution*, is not difficult to be diſtinguiſh'd from that which is perform'd by a true and proper *Precipitant*, (as in our caſe by the *Common Salt*, that is harbour'd in the Pores of the *Water*) both by the Quickneſs of the Effect, and the Copiouſneſs of the white Subſtance produc'd, and on both thoſe Accounts is very much inferiour to it; as may evidently appear in the very different Effects that our *Solution* of —— had upon the *Patentees Water*, compar'd with thoſe it had upon *Water* Impregnated with a *thouſandth* part of *Salt*, and upon divers Common *Undiſtilled Waters*.

But

But to return; The Uſefulneſs of this Experiment is not to be Eſtimated only by the *Examen* it helps us to make of *Dulcify'd Sea-Water*, but much more by the Eſtimate, that by its means may be made of *natural Freſh Waters*, whether of *Springs*, *Rivers*, *Clouds*, *Lakes*, *Wells*, *&c.* For it being generally granted, that thoſe Waters, *cæteris paribus*, are the beſt, as well for the Wholeſomeneſs, as divers Oeconomical Uſes, as *Waſhing*, *Brewing*, *&c.* that are freeſt from *Saltneſs*, which is an Adventitious and in moſt caſes, a hurtful Quality of *Waters*; by our way of *Examining* theſe Liquors, a heedful Eye may in a trice diſcover, whether there be any latent Saltneſs in them (as moſt Waters Imbibe from the Soyle they have Travers'd or do Stagnate in) and may enable one, eſpecially by the help of a little Practice, to give a near gueſs, how much one Water is Freſher than another, as I have purpoſely try'd with pleaſure in differing Waters, that are ordinarily Drunk, even by conſiderable Perſons. And if once you have attentively marked, what change 4 or 5 *drops*, for inſtance, of our Diſcovering Liquor will make in *two* or *three*, or ſome other ſmall determinate Number, of *Spoonfulls* (or rather of *half Ounces*) of *Water*, 'twill not be difficult for a heedful obſerver, keeping the ſame proportion between the two Liquors, to make a near Eſtimate, whether any natural Water propoſed to him, have a greater, an equal, or a leſſer degree of Freſhneſs or Saltneſs, than that Water that he has choſen for his Standard; and how much in caſe there be a difference, the propos'd Liquor is leſs or more free from Saltneſs than the other.

And that (to add this upon the by) ſuch a Difference in a Liquor of ſuch frequent inward uſe as Water (which is the *Baſis* of *Beer*, *Ale*, *Mead*, and ſome other common *Drinks*) may have conſiderable effects upon Human Bodies in reference to *Health*, may be probably argued from the differing Effects that Waters more or leſs Impregnated with Salt, have upon divers other Bodies. Since moſt *Pump-Waters*, for inſtance, will not Boyl Peas and Beef, and ſome other Aliments, near ſo well as Spring-Water or Rain-Water, which are uſually Softer, and more free from the Saltneſs we ſpeak of. 'Tis commonly known to Barbers and Laundreſſes, that the ſame *Pump-Water* will not ſo well and uniformly, or without little Curdlings Diſſolve Waſh-Balls and Soap, as *Rain-Water*, and ſome *Running Waters* uſually will: Nay, when I was curious of *Tempering Steel*, I remember 'twas confeſs'd by the Skillfulleſt Artiſts I made uſe of, that ſome Tools (as Gravers, *&c.*) made of that Hardeſt of *Metals*, would receive a differing *Temper* if they were quenched in *Pump-Water*, from that which the like Extinction in Spring-Water, or River-Water would give them.

I might add on this occaſion, That, whereas Experience has inform'd ſeveral Perſons, who have conſulted it, that divers *Medicinal Waters*, that are preſumed to own their Virtues to the participation either of *Metalline*, or of other *Mineral* Bodies, do upon *Tryal* appear to leave ſometimes little, and ſometimes nothing behind them, except a kind of *common Salt*; our Precipitant may much aſſiſt Men to diſcover, whether a *Mineral Water* propos'd to be examin'd, do, or do not contain, ſuch a *Salt*, and if it do, whether it contain it copiouſly or no. This I have tried upon more than one of our *Engliſh Mineral Waters*, and thereby found in a trice, that one that is reputed of another Nature, contained pretty ſtore of *ſaline matter*, and that another, which is ſtill for ought I have learned, of an unexamin'd and unknown Nature, is *impregnated* with a ſurpriſing *plenty* of *ſaltiſh ſubſtance*, but how and with what *cautions* our *Precipitant* may be moſt uſefully employ'd, about the *Examen* of *medicinal* and other *mineral Waters*, belongs not to this place. Upon which Account, I forbear to declare the uſe I have ſometimes made of our *Precipitant*, in examining the *freſh Urine* of *men*, the *Serum* of *human Blood*, and other Bodies belonging to what the *Chymiſts* call the *Animal Kingdom*.

I have not, for certain Reaſons, aſcribed to our Method of examining *Waters* a greater nicety than to be able to diſcover *one* part of *Salt* in a *thouſand* of *Water*, that Proportion being great enough to recommend it, and expreſs'd by a round Number eaſy to be retained in ones Memory: Yet I would not have it thought but that, if it were requiſite, our *method* may make more nice Diſcoveries. For having ſometimes for Curioſities ſake, put one *Grain* of *Salt* into no leſs than 1500 of diſtill'd Water, we could manifeſtly, tho' not quite ſo conſpicuouſly as before, make it appear by our way, that even this ſo lightly impregnated Liquor was not devoid of *Salt*, but had more of that in it, than ſome of the *Patentees Water* that I kept by me had; nay, I once found, that a *Grain* of dry *Salt* being diſperſed thro' 2000, and another time, that being diſſolved in 3000 times its Weight of the ſame kind of Liquor, ſo inconſiderable a Proportion of *Salt* was plainly diſcoverable by our *Precipitant*.

It may be objected, That whereas the *Experiments* hitherto mentioned, have been try'd only upon *Waters* impregnated with groſs or corporeal *Sea-Salt*, this perhaps may not hinder; but that they may be imbued with the *Spirits* of *marine Salt*, which by reaſon of their Activity may be as unhealthful to the *Drinker*, as the groſſer Salt it ſelf. But tho' to this ſurmiſe, I might anſwer, that a very ſmall Proportion of *ſpirit* of *ſalt*, may in many caſes make the *Water* ſeaſon'd with it, rather *medicinal* than *unwholſome*, yet I ſhall anſwer more directly to the Objection, by ſaying, that to manifeſt it's not being well grounded, I took above 1000 *Grains* of *diſtill'd water*, and inſtead of *corporeal Salt*, put to one ſingle drop of moderately ſtrong *ſpirit* of *ſalt*, for I had much ſtronger by me, that I purpoſely declin'd to employ, and having ſhak'd it into the *Water*, I let fall into a portion of this unequally compoſed Mixture, ſome drops of our Solution of Silver, which preſently began to precipitate in a whitiſh foam, inſomuch that for ought appeared to the *Eye*, this Trial ſucceeded better than if the *Water* had been impregnated with but 100. *th* part of *corporeal ſalt*. The like *Experiment* was made with the *Patentees Water* inſtead of the other. And to purſue this Trial a great Way further, I had the Curioſity to diffuſe one drop of Spirit of Salt into 2000 Grains of diſtill'd Rain Water; and upon letting fall ſome drops of our Precipitantin to it, I found that the Succeſs well anſwer'd my Expectation.

And then, to urge the Trial yet farther, I added as much of the ſame Diſtill'd Rain Water, as by a modeſt Conjecture made it amount to at leaſt half.

half as much more. So that one *Grain of ſpirit* of *ſalt* had a manifeſt Operation, tho' not quite ſo conſpicuous as the former, upon above 3000 *Grains* of *Water*, whoſe Immunity from common Salt we tried apart. And that a Drop of the *ſaline Spirit* we made uſe of, did not equal in weight a Grain of dry *Salt*, I found by this, that having let fall into a counterpois'd piece of Glaſs, ten Drops of that Spirit, I found them to want near half a Grain of 9 Grains Weight.

The like Trial I made by ſubſtituting above 1000 Grains of Rain Water in the Room of the like Quantity of diſtill'd Water.

It is the opinion of ſome *Seamen*, and of a Perſon for whom I have a profound reſpect, that *Water* ought to have a little *Saltiſhneſs* to preſerve it; if this be really a deſirable Quality in our *artificial Water*, it may in a trice be ſupplied with as much *ſaltneſs*, whether *corporeal* or *ſpirituous*, as ſhall be required, and conſequently as will bring it to be equal in that quality to the common *Water* of *Rivers* or of *Springs*. And perhaps 'twill not be impertinent to add on this occaſion, that in ſome places, eſpecially lying in hot Climates, it may ſometimes be of good uſe to know, whether on the account of the Sun's Heat, or that of the *ſubterraneal Regions* of the *Earth*, the *Rain-water* is impregnated with *volatile*, not *acid*, *Spirits*, like thoſe that are diſtill'd from *Urine*, and which I have for Curioſities ſake, obtain'd from a mineral Body, *native ſal-armoniack*; upon which account I made a Trial that inform'd me, that if 5 or 6 drops of *ſtrong Spirit* of *Urine*, whoſe drops I obſerved to be but ſmall, were ſhaken into 1000 *Grains* at leaſt of diſtill'd or Rain-water, impregnated but with one of *Salt*, our *Precipitant* would make a Diſcovery of ſome *ſaltiſhneſs* in the *Liquor*. And it were neither to be admired nor cenſur'd if the *Patentees water* ſhould ſometimes ſhew a *Change*, when our *Precipitant* is *plentifully* put or long kept in it, eſpecially that *Change* being a more light one, than that I came from ſpeaking of Since for ought I have yet obſerved, not only ſuch *undiſtill'd waters* are generally allow'd to be freely potable, but even thoſe that *Nature* her ſelf diſtills, are not always quite devoid of ſaltneſs.

For I have found Rain-water, that I caus'd carefully to be ſav'd after the Houſe-tops had newly been well waſh'd with former Rain, to grow a little troubled, if any Store of our *Precipitant* were kept for ſome competent time in it. And being gently diſtill'd off, it left a Reſidence, which with a little of our Solution afforded a far more ſuddenly made and copious *Precipitate*, than had been produc'd with the like quantity even of Pump-water it ſelf. And tho' I have met with Rain-water, that was more free from Salt than any Spring or River-water, that I remember I have examin'd, yet having for Curioſities ſake made Trial of Snow-water, which if the Weather had been ſomewhat milder, would have been Rain, this Liquor I ſay, which is thought to afford the lighteſt Water of all natural ones, I manifeſtly found by our way of examining it, not to be devoid of Saltneſs.

It has been ſurmis'd by ſome, that even a moderate action of the *Fire* upon *Water*, will make it brackiſh and putrifie. But that the *Patentees water* is not *brackiſh*, appears by the foregoing Trials; and that it is more free from Saltneſs, than moſt of the Waters Men do without ſcruple drink: And that it may keep ſweet longer than is neceſſary in a ſhip, that can from time to time within a few days, ſupply it ſelf with *freſh* out of the *Sea*, may be gathered from theſe 2 things; The firſt is, That I cauſed a pint of it to be *hermetically* ſeal'd in a Vial, whereof I left, by gueſs, about a 3*d* part empty, and having about 6 *Weeks* after, held this Veſſel againſt the *Light*, I found the *Water* to be clear and limpid; tho' I did not judge it had depoſited ſo much as the tenth part of a *Grain* of *Feculency*. And having opened the *Seal*, and taken out a little of the Liquor, I did not find it alter'd either as to *Smell* or *Taſte*. The *ſecond* is, that I have kept a *Bottle* of it in the ſame unſtopt Veſſel near 8 *Months*, and yet it continues ſweet and well condition'd. And if that which is call'd *Crudity* in *Water* does conſiſt, (as probably it oftentimes does) in certain groſs particles that are mingled with the purely aqueous ones, it is likely, that the Action of the Fire may divide and diſſipate theſe into minuter Particles, and thereby deſtroy the Texture that makes them hurtful; and by cauſing innumerable Tumblings and Rovings amongſt the more earthy Particles, give them Opportunity to make little *Coalitions*, whoſe Weight precipitating them to the bottom, frees the pure water from them.

And becauſe 'tis but too probable that the *unwholſomneſs* of divers *Waters* proceed, not only, or perhaps not ſo much, from bare *Crudity* as from a great quantity of groſſer *particles*, that are not eaſy to be rais'd, becauſe of their being combin'd with fixt and earthy ones, that ſwim up and down in the *Water* they impregnate, as *Silver* or *Mercury* does in a *Solution* made with *Aqua fortis*, or rather as the Particles of Salt do in *Pump-water*, and many other *common Waters*: On this Account, I ſay, the *Patentees* invention may very much correct ſuch *Waters*, ſince by their way of ſweetning thoſe Liquors, the truly aqueous parts are not only freed from the ſaline ones, but from the mineral, and other groſs and hurtful *Corpuſcles* that may have lain conceal'd in the Liquor. As may be argued from hence, that having purpoſely in the gentle Fire of a digeſtive Furnace, ſlowly diſtill'd off a Pound of the *Patentees Water*, it left us in the *Cucurbit* ſo light and thin a *Feculency*, that the *Bottom* of the Glaſs ſeem'd to be rather ſullied than cover'd by it; and I did not judge that the whole *Feculency*, if we could have got it out, would have amounted to ſo much as 2 Grains.

Perhaps it was upon ſome ſuch Reaſons, that the laſt *Great D.* of *Tuſcany*, when he drank *Water*, preferr'd for *wholſomneſs*, that which was *diſtill'd* to that which was not; and if herein that learned Prince, and thoſe of the ſame opinion were not miſtaken, it will highly recommend the uſefulneſs of the *Patentees Invention* to Mankind. For there are Multitudes of *Waters* that are not conſiderably *brackiſh* to the Taſte, that yet, by reaſon of ſome unheeded *Saltneſs*, as in moſt *Pump-waters*, more frequently by reaſon of *Crudity*, are not only unfit, or at beſt, leſs fit for divers *Oeconomical Uſes*, as *Waſhing*, *Boiling* of ſome *Meats*, &c. but are very unwholeſome; ſometime to a degree, that makes them miſchievous to whole *Communities*, and perhaps *Nations*. I remember I have ſeen a notable *Inſtance* of this in thoſe *huge* and *unſightly Tumours* about the *Throat*, which are obſerved by *Travellers* to be exceeding common, among thoſe that inhabit the lower *Tracks* of Ground that lie between the *Rhætian*, *Helvetian* and ſome other neighbouring *Mountains*; which monſtrous *ſwellings* are generally imputed to the *Snow-waters* that flow from the *Mountains*, and make the uſual Drink of the meaner ſort of People; whence 'tis obſerv'd that Perſons of better Condition, who drink *Wine* more than *Water*, are either not at all, or far leſs troubled with theſe *diſfiguring Goitres*, (as they call them.) But much more notable *Inſtances* to our preſent purpoſe are afforded me, by that great and yet living *Traveller*, *M. Tavernier*, Baron of *Aubonne*, who ſpeaking of a Nation of *Cafres* or *Negroes*, that come ſometimes to trade with the *Portugueze* from a remote part of *Africk*, informs us, '*That the Water of their Country is very bad, which is*, (ſays he) *the Reaſon that* '*their Thighs do ſwell, and it is a Wonder to ſee any of them free.* Nay, which is far more, where he ſpeaks of the *African* Kingdom, or Empire of *Monomotapa*, he has this memorable Paſſage, '*The Natives never live long, by reaſon* '*of the Badneſs of the Waters in the Country. For at the Age of 25 they begin to be dropſical, ſo that 'tis a great Wonder if any among them live above 40 Years.*

Theſe People might probably be much reliev'd, and be brought to live as long as other Nations, if they had ſo compendious a way as that of the *Patentees*, to provide themſelves plentifully with Waters whoſe *Crudity* is corrected; its groſſer and heavier parts ſeparated, and its *Brackiſhneſs* deſtroy'd by the Fire, as its Action is regulated and help'd by their Invention.

The Experiment mention'd in this Paper was try'd at a *Meeting* of the *R.S.* *Feb.* 17. $169\frac{1}{2}$. by Dr. *Sloane*, with a Succeſs anſwerable to the Aſſertions of the honourable Author, and that a Drop or two of Spirit of *Salt*, mixt with *common Water*, would be by the ſame Method diſcovered.

By Dr. Hook, ib. p. 639. 2. At a *Meeting* of the *R. S. Mar.* 2. $169\frac{1}{2}$. Dr. *Hook* read a Lecture concerning a Method of his own for the diſcovering the ſmalleſt Quantity of *Salt* contained in *Water*, from a Principle of *Hydroſtaticks*; and after his Diſcourſe thereof, he produced the *Apparatus* which he had prepared to exhibit the ſame before the Perſons then preſent.

The *Method* of doing which *Operation* was by means of a large *Poiſe* of *Glaſs*, ſomewhat of the ſhape of a *Bolt-head*, the *Ball*, of which *B* was about 3 Inch. Diam. but the *Stem* or *Neck* thereof *CC*, was not above $\frac{1}{4}$ of an Inch. This was ſo poiſed by Red-Lead put into it, as to make it but a little heavier than fair or freſh Water. Then this *Poiſe* was ſuſpended by the ſmall *Stem* to the end of a ſlender *Beam*, *A*, which was very tender, and being not overcharg'd with Weight, would turn with a ſmall part of a Grain. This *Beam* was hung on a *ſteady Frame*, and the *Poiſe* hanging at one end of the ſame, covered with the *Water* to a certain *Mark* or *Diviſion* made on the ſmall Neck, at *D*, it was ſo counterpoiſed by ſome ſmall weights put into the oppoſite Scale of the Balance, *F*. Then the *Weight* of the *Water* contained in the Ciſtern or Veſſel, *EE*, into which the Poiſe was immerſed, (being firſt known, a 2000*th* part of its Weight, was taken of common Salt, weighed out, and put into the whole 2000 *parts* of the *Water*, which by being ſtirred, ſoon diſſolved. Then the *Poiſe* ſuſpended as before, was view'd and examined by many then preſent, and they manifeſtly ſaw, that near half an Inch more of the Neck emerged out of the *Water* ſo ſeaſoned, than did before the 2000*th part* of *ſalt* was *diſſolved* therein.

This was only one uſe of this Method of diſcovering very ſmall *Alterations* in the *Conſtitution* of *Bodies*, the ſame *Author* having long ſince, namely, *Octob* 25. 1677. Shewn to the ſame Society a Method of diſcovering divers *Alterations* much more curious, namely to the 176000*th part* of its *Weight*.

XVII. There is an old Spring in the Dioceſs of *Paderborn* in *Weſtphalia*, which loſes it ſelf twice in 24 Hours; coming always after 6 Hours back again with a great Noiſe, and ſo forcibly as to drive 3 Mills not far from its Source. The *Inhabitants* call it the *Bolderborn*, as if you ſhould ſay, the *Boyſter.us Spring*.

An Ebbing Well in Weſtphalia, *by* . . . . . n. 7. p. 127.

XVIII. *Lay-well*, near *Torbay*, is about 6 *Foot* long, and 5 *Foot* broad, and near 6 *Inches* deep which ebbs and flows very often every Hour, viſibly enough. I am informed, 'tis moſt conſtant Winter and Summer, tho' I am apt to think it moves faſter in Winter, when the *Well* is fuller, than in Summer: Becauſe when I obſerved it firſt, (in *July* 1693) I think it flowed ſomewhat quicker than I found it did on my ſecond *Obſervation*, toward the End of *Auguſt* following; for the *Water* was then conſiderably ſhrunk in the Well, notwithſtanding we had for about a Fortnight much Rain: And tho' when once it began to flow, it performed its Flux and Reflux, in little more than a Minute's Time. yet I obſerved it would ſtand at its loweſt Ebb ſometimes 2 or 3 Minutes; ſo that it ebbed and flowed by my Watch, about 16 Times in an Hour, and ſometimes I have been told 20. As ſoon as the *Water* in the *Well* began to riſe, I ſaw a great many Bubbles aſcend from the *Bottom*, but when the *Water* began to fall, the Bubbling immediately ceaſed. I meaſured its high and low Water Marks, and found them between 5 and 6 Inches diſtant; not of Perpendicular Depth, but as it ſpread it ſelf on a broad Stone, as the Sea does on a Beach or Shore. Tho' I am apt to think its perpendicular Height would be as much, or more in that Time, were its Out-let damm'd up to try an Experiment; For as it riſes, it runs out with a ſmall Stream, which is greater or leſs, according as the Water in the *Well* riſes and falls.

An Ebbing Well *near* Torbay, by *Dr.* Wm. Oliver, n. 204. p. 909, 910.

That it has any *Communication* with the *Sea* is not manifeſt, nor is the *Water* brackiſh at all. The whole Country adjacent is very hilly all along the Coaſt, in ſo much that from *Brixham* to the top of the Hill, is about a Mile and half; and the Well is about half way up the Hill, (which hereabout is ſomewhat uneven and interrupted) and comes out at a ſmall Deſcent, yet conſiderably higher than the Surface of the Sea.

I tried it with an *Oaken Leaf*, as ſoon as I ſaw it the firſt Time, but could not find it change Colour. I drank of it, 'tis very ſoft and pleaſant, has no manner of Roughneſs in it, and ſerves for all manner of Uſes to the Country People in their Houſes; they alſo uſe it in Fevers, as their ordinary Diet-drink which ſucceeds mighty well.

The Zirchnitzer Sea *in* Carniola *deſcribed; By* Dr. Brown, n.54.p.1083 n 109.p.154

XIX. 1. Having croſs'd the River *Dravus*, and paſſed Mount *Luibel* in the *Carnick Alps*, by that noble Paſſage cut thro' the Rocks, and vaulted like that of *Pauſilyppe* near *Naples*, I went to *Brounizza*, 2 Leagues from whence, and beyond the Hills, is the *Zirchnitzer Sea*, receiving that Name from *Zirchnitz*, a Town of about 300 Houſes.

This Lake is near 2 *German* Miles long, and one broad. On the South ſide thereof lies a great Foreſt, and on the North-ſide the Country is flat; but the whole Valley is encompaſſed with high Hills, at ſome little diſtance from it. But I ſaw no Snow upon them, tho' upon other Mountains in the Country, I obſerved Snow in *June*. Upon Hills on the ſide of great Lakes, the Snow lies not ſo long as upon Hills more diſtant.

This *Lake* is well fill'd with Water for the greateſt part of the Year, but in the Month of *June* it ſinketh under ground, not only by *Percolation*, or falling thro' the Pores of the Earth, but retireth under ground through many great Holes at the Bottom of it; the little, if any, that remains in the hilly or rocky Part is evaporated: And in the Month of *September*, it returns by the ſame, and in a ſhort time covers the Tract of Earth again, but I cannot determine the ſpace of Time to a Day. This *Return* and *Aſcent* is ſo ſpeedy, and it mounteth at the Holes with ſuch Violence, that it ſprings out of the Ground to the height of a Pike. The *Water* that ſpouts ſeems ſomewhat clear in the Air, but being ſpread about, looks as formerly in the *Lake*.

The Holes generally are ſtony, not in ſoft or looſe Earth; yet in one or two places the Earth hath been known to ſink, and fall in, particularly near a Village call'd *Sea-dorf*. They are of different Largeneſs and Figure; ſome perpendicular, at the beginning, and then Oblique; others oblique at firſt, ſcarce two exactly alike. Such Holes I have ſeen in other parts of *Carniola*, and in other Countries alſo. We have a Hole call'd *Elden Hole*, not made by Art, but naturally, in the Mountains in the *Peak Country* of *Derbyſhire*, above 80 *Fathoms* deep. The great Holes are the ſame every Year, but poſſibly part of the Water may ſometimes find or make new Paſſages thro' the Crevices and cribrous Parts of the Field.

When the *Water* goeth firſt away, they ſee it in theſe Holes for a while, but afterwards it deſcends lower out of their Sight.

This Piece of Ground in the time of the Retirement and Abſence of the *Water*, is not unfruitful, but by a ſpeedy and plentiful Production of *Graſs*, yieldeth not only a preſent Suſtenance for the Beaſts of the Field, but a good Proviſion of *Hay* for the Cattle in *Winter*.

The *Lake* is not only thus fill'd with *water*, but every year well ſtored with *Fiſh*. The Prince of *Eckenberg* is Lord of it, and of much Country thereabout. But upon the retiring of the *Water* all have Liberty to fiſh; and the *Fiſhermen* ſtanding up to the *Waſte* at the *Holes* before mentioned, intercept the paſſage of the *Fiſh*, and take a very great Number of them, which otherwiſe would be ſecure for ſome *Months* under the *Earth*, and not fail to return in *Sep*. But at that time the Prince will not permit them to make any ſuch attempt.

The *Fiſh* of this *Lake* have a cloſer Habitation than thoſe of any other I know; for they paſs ſome Months under the Earth, and a good part of the *Winter* under Ice. I could not learn that there were any *Otters* in this *Lake* which otherwiſe muſt probably have taken the ſame Courſe with the *Fiſh*, not that there were any remarkable extraneous Subſtances, any Vegetables, or unknown Fiſhes brought up by the Water, but thoſe which come up are of the ſame kind with thoſe which deſcend.

The Bottom of the *Lake* is not even, nor near about the ſame depth, but ſometimes 2 Foot, and then ſuddenly 20 Yards deep. And becauſe the Fiſh haunt the deep places more than the Shallows; they have given Names to the ſeven chiefeſt Cavities or Valleys in the *Lake*.

The Water is not always at the ſame height, but ſomewhat differing according unto Rains, Snows, or Drought; and they are ſenſible of its height by the tops of the Hills in it, and its ſpreading toward *Zirchnitz*, but it alters not very much till it begins to go away.

No River enters it, but only inconſiderable *Rivulets* on the South and Eaſt ſide; nor hath it any other diſcharge known, but by the Holes.

There are alſo divers Caverns and deep places in the Country of *Carniola*, even where there is no Water.

Between *Sea-dorf* and *Nider-dorf*, the ground ſometimes ſinks in ſeveral Places upon the ſudden retiring of the *Lake*; and the aforeſaid Prince of *Eckenberg* was once ſo curious, as to deſcend into one *Hole*, thro' which he paſſed under a Hill, and came out on the other ſide; as I was inform'd by M. *Andreas Wiſer*, the preſent Judge of *Zirchnitz*, and alſo by *Johannes Wiſer*, who hath formerly held the ſame place.

The Country is high about the Lake, but the Lake is not high in Reſpect of the Country near it, but low.

The Snow falls not till after the Lake is return'd.

This *Lake* probably may hold dependance of, and communication with ſome ſubterraneous great *Lake*, or *Magazine* of *Water* belonging to theſe hilly Regions, which when full, and running over, may vent it ſelf with force and plenty into this Field, and when ſcant of *Water*, abſorb and drink in the ſame again; the *Water* of the *Lake* returning but from whence it came, having no River running out of it whereby to be diſcharged.

I went alſo to a noted Stone, commonly call'd the *Fiſhers-ſtone*, which hath ſomewhat of the uſe of the *Nileſcope-pillar* at *Grand Cairo*. It is a large Stone upon one of the Hills, or elevated parts of the Field, which whenſoever it appears above *Water*, the *Fiſhermen* being upon the *Lake*, take notice of it, and know thereby, that in a few days the *Water* will retire under Ground. For after the filling of the *Lake* in *Sept.* the *Water* never decreaſeth ſo low again, as to let the *Fiſherſtone* appear, till it begins to retire under Ground.

2. This *Lake* was by the *Ancients* call'd *Lugea Palus*, by the Moderns, *Lacus Lugeus*, tho' at preſent its *Latin* Name be *Lacus Cirknicenſis*, in *High-dutch*, *Zirchniſerſee*, and in our *Carniolan* Tongue, *Zirkniſco Jeſero*. Why it was ſo called of old, is unknown, or very uncertain, but the *Original* of the preſent Name is more ſure, it being derived from the adjacent Town of *Cirknits*; and that had its Name from a *Chappel* of the *Virgin Mary*, which at firſt ſtood alone, but now the *Town* is built round it. This *Chappel* was no great Edifice at firſt, and therefore was called the *little Chappel*, which in the *Language*

By M J. Weichard, Valvaſor, n.191.p 411

of the Country is *Zirkviza*; whence the *Lake* was named *Zirkviſco Jeſero*, or the *Chappel-Lake*, but now by Abuſe, *v* being changed into *n*, *Zirkniſco Jeſero*.

It is diſtant from the Capital City of the Province *Labac*, 6 *German* Miles, it is a good *German* Mile long, or better than 4000 *Geometrical Paces*, and is about half as much in breadth. Its ordinary Depth is 10 *Cubits*, its leaſt 5 or 6, rarely 3, but its greateſt is 16 Cubits. It is every where ſurrounded with woody Mountains which on the South and Weſt-ſide are very high, and 3 Miles broad, running far in length into the *Turkiſh* Country, and afford nothing but horrid ſtony Deſerts, overgrown with Trees. On the North and Eaſt-ſide, there is between the Mountains and the Lake, a ſmall Territory, which tho' narrow, is nevertheleſs pleaſant, and is inhabited by one Town, 3 Caſtles, and 9 Villages, and adorned with 20 Churches; as may be ſeen in the Map, which was drawn by my ſelf npon the place, with all poſſible care.

Fig. 60.

In the Mountain call'd *Javornik*, ſtanding near the Lake, there are two *Holes*, or exceeding deep Precipices, in which many thouſand wild *Pidgeons* rooſt all the Winter; entring in *Autumn*, and coming out with the firſt of the *Spring*: What they live upon in theſe *Caverns* is unknown, but I take it to be the *nitrous* Sand. In another Hole call'd *Slivenza*, 'tis the Belief of the Country People, that the *Witches* hold their Aſſemblies, becauſe that ſeveral times Lights like *Ignes fatui* are obſerved there. On the Top of this Hill is a hole of an unknown depth, out of which there often breathe out noxious Steams, ſuppoſed to occaſion Tempeſts of Thunder, and Lightning, and Hail; and for this reaſon the *Prieſt* of *Zirknits*, every *Whitſon-Monday*, goes to the Hole in Proceſſion, and uſes over it a certain Form of *Exorciſm*.

There run into this *Lake* continually 8 Rivulets. The two leaſt are call'd *Bellebrech* and *Treſenz*, the 3*d* is the Fountain *Oberch*, out of which abundance of *Water* guſhes with great Force; the 4*th*, 5*th*, and 6*th*, call'd *Steberziza*, *Linſinziza*, and *Seromſchiza*, may for their Bigneſs deſerve the Name of Rivers; the 7*th Martinſchiza*, breaks out at a Cleft in the Rock: The laſt called *Cirknizer-bach*, is a pretty large River.

Now this *Lake* being every where ſurrounded with Mountains, and no where running over, Nature has given it two viſible Channels, or ſtony Caverns, call'd *Velka Karlouza* and *Mala Karlouza*, by which the Water runs under the *Mountain*; and a 3*d* concealed ſubterraneous Paſſage, which without doubt communicates with the other 2 under ground (as I ſhall hereafter prove) Theſe having run half a *German Mile*, come out at the other ſide of the *Mountain*, near the *Chappel* of *St. Cantian*, as I have faithfully drawn it, in a *Deſert-place*, at a ſtony *Cave A*, and become the *River* called by the Inhabitants *Jeſero*, that is the *Lake*. This *River Jeſero* marked *B*, is reaſonably big, and having run half a quarter of a Mile, enters a wide *ſtony Cavern I*, running ſlowly under the Hill for the ſpace of a good *Muſquet-ſhot*; then coming out again on the other ſide, after it has run thro' a ſmall *Plat m m*, it enters a 3*d Cavern* or *Grotto C*, wherein having paſſed 50 paces, one may ſay *Siſte viator, ne plus ultra*, for it runs no longer *peaceably* as before, but with

Fig. 61.

great Noiſe and Roaring falls down a very much inclined Channel of Stone, ſo that neither I nor any elſe durſt follow it farther. In *June* 1678. I went my ſelf in a ſmall Fiſher-boat under the Mountain, through the Cave *F*, and entred the *Grotto C*, till I came to the aforeſaid Falls, without any danger or trouble, the paſſage being wide enough.

It muſt be noted, that the Valley wherein this River *Jeſero* runs, is exceeding ſteep, but the Plat of Ground *m m*, is plain and ſtony, of an Oval Form, and is ſurrounded with (as it were) a very high Rampart *KKK*, ſo ſteep that it would be impoſſible for a Cat to climb out of it, unleſs at one place, whereat a Man may make a Shift to go up and down, tho' not without peril of his Life; the way being in ſome places not above three or four inches, and no where above 6 inches wide. In the Year 1684, I went down here in Company with a *French* Gentleman, but the Water being up and we wanting a Boat, we could not go under the Hill, nor enter the *Grotto C*; ſo we returned, and with great difficulty deſcended by a Steep and narrow Paſſage at *D*, and came to a Cave bigger than any Church, through which the River *Jeſero* runs. Here we found ſeveral Figures of Stone, the Workmanſhip of Nature, and ſtrange Holes and Caverns in the Earth; but by reaſon the River was then up, we could go no farther. At other times when the Water is down, one may go with lighted Torches a great way under ground; and it is ſaid there are here very odd Figures formed by the Petrified Water: Among the reſt one reſembling a Weaver at Work, of which the Country People want not their Superſtitious Traditions.

But to return to our Lake; I ſay that about the Feaſt of St. *James's-Tide* and ſometimes not till *Auguſt*, the Water runs away and it is Dry: But it Fills again and moſt commonly in *October* or *November*, yet ſo as not to obſerve any certain time; for ſome times it has been Dry twice or thrice in a Year: As in the Year 1685, it was Dry in *January*. Again the Water began to draw off, on the 15 of *Auguſt*. *St. N.* and it was quite Clear by the 8*th* of *September*; and this preſent Year 1687, it has been thrice Empty, which makes the Fiſhing very poor and inconſiderable. Sometimes again, tho' but ſeldom, it has happened to be three or four Years together Full of Water, and then is the beſt of the Fiſhing. But it never yet was obſerved that this Lake was dry for a whole Year together.

The Right of Fiſhing in this Lake, upon certain Terms agreed on, does at this time belong to the Lordſhips or Caſtles following, 1. to *Haaſperg*, 2. *Steegberg*, 3. *Laas*, 4 *Schneeperg*, 5. *Aveſperg*, 6. to *Sitticium*, which is a Monaſtry of *Ciſtertian Monks*.

There are 3 Iſlands in this Lake, *viz. Mala-Goriza* and *Velka Goriza*, which are uninhabited. The 3*d* is a very pretty Iſland called *Vornek*, that is reaſonably big, having upon it a Village of 4 Houſes called *Ottock* above this Town upon a little Eminence ſtands a Church, which is no ſmall Ornament. Thoſe that live on it have Fields, Meadows, Paſtures, Wood, Gardens and Orchards, and all things neceſſary for Life.

There is alſo a very fine *Peninſula* all covered with Wood, called *Dorvaſek*. When the Lake is up, and one comes in a Boat between the Iſland *Vornek* and this *Peninſula*, the farther part of the Lake, lying under the Mountain, very well reſembles a curious Port for Shipping. At the farther end when the Water draws off, there appears Rowes of Stakes, a Signe that there hath been formerly a *Bridge*, and therefore it is at this Day called the *Old Bridge*.

In this Lake there are many Pitts in the ſhape of Baſons or Cauldrons, which are not all of the ſame depth or breadth; the breadth of them being from 20 to 60 Cubits more or leſs, and the depth from 8 to 20 Cubits. In the bottom of the Pits are ſeveral Holes, at which the Water and Fiſhes enter, when the Lake Ebbs away.

Fig. 60. The principal Pits in which they Fiſh, are 18, ſituated and named as is repreſented in the Map. They are called *Maljoberch*, *Velkjoberch*, *Kamine*, *Sueiuſkajamma*, *Vodonos*, *Leuretſchka*, *Kraloudour*, *Reſcheto*, *Ribeskajamma*, *Rethje*, *Sittarza*, *Lipanza*, *Gebno*, *Koteu*, *Ainz*, *Zeſlenza*, *Pounigk*, and *Leviſhe*. Beſides theſe there are ſeveral other leſſer Pits of no note, becauſe there is no ſuch Fiſhing in them as in thoſe but now mentioned.

In the Months of *June*, *July* and *Auguſt*, when this Lake begins to draw off, it grows quite Dry in 25 Days, if no great Rains Intervene. And the aforeſaid 18 Pits are all Emptied the one after the other, in a certain and never failing order of Time.

When the Lake begins to Sink, which appears by a certain Stone, which they obſerve, the Inhabitants of the Town called *Oberdorff* or *Seedorf*, give notice thereof to all the Neighbouring Fiſhermen, that are appointed by the ſeveral Lords having Right in this Fiſhing. The People of this Town have Orders not only to watch the Falling away of the Water, but likewiſe to take care that no Body preſume to Fiſh in the Lake when it is Full of Water; that being forbidden: So that theſe are, as it were the Keepers of the Lake.

1. The firſt Pit called *Maljoberch*, is not properly a Pit like a Cauldron, but only a Depreſſion of the Bottom without any Holes in it: But there grows much Graſs and Weeds, and many Fiſh are Catched therein: Three Days after the Water beings to Ebb, this Pit is Emptied: Then the Pariſh Clerk of *Seedorf* gives notice thereof by Tolling a Bell, and all the Inhabitants of the Town, Old and Young, Men and Women, lay aſide all other Buſineſs and go to Fiſhing, ſtark Naked as ever they were born, without any regard to Modeſty or Shame.

The Fiſh they Catch they divide in halves, one part they give to the Prince of *Eggenburg*, as the Lord of the *Mannour*, the other half is their own.

2. The Pit *Velkjoberch* is empty the 3d pay after *Maljoberch*, the manner and Right of Fiſhing as in that.

3. Four Hours after this, the Pit *Kamine* begins to empty; here they generally Fiſh with a Trawle, as in ſeveral other Pits of leſſer Note, having firſt purchaſed leave of the aforeſaid Lord of the Mannour. Here, as likewiſe in the Pit.

4. *Sueiuſkajamma* (which ſinks one hour after *Kamine*) is much Fiſh caught, and abundance of large *Crabs*, but they are lean and of no good Taſt.

5. The fifth Pit *Vodonos*, dries 5 days after *Kamine*. In this and the other Pits which follow they Fiſh with a long Net or Sayne. Herein they can have

no more than 5 or 6 Hawls, by reaſon of the great Swiftneſs wherewith the Water runs away at the Holes in the bottom, (which is ſuch that a Horſe can hardly keep pace with it) and carries away the Fiſh with great Violence under the Earth. Sometimes when Fiſhermen are not nimble, they can ſcarce get two Hawls before the Water be gone; to prevent which they have a Mark near this Pit, *viz.* the *Stone Ribeskekamen*, that is the *Fiſher's-Stone*, which as ſoon as it begins to appear upon the Receſs of the Water, gives notice that it's time to begin the Fiſhing.

6. The Pit *Lourretſchka* is evacuated a Day and half after *Vodonos*, the Fiſhing is after the ſame manner, and the ſame Caution neceſſary, becauſe of the ſuddain Receſs of the Water.

7. The Water leaves the Pit *Kraloudour* 12 hours after *Louretſchka*; and 3 Days after that.

8. The Pit *Reſcheto*. In this latter, in the Year 1685, after the Lake had been ſome Years without being dry, there were taken at the firſt Hawl, 21 Carts of Fiſh, at the 2*d.* 17, and at the 3*d.* 9, as I have been credibly informed by thoſe that were preſent.

9. The Pit *Ribeskajamma* falls dry at the ſame time with *Reſcheto*, which is that next to it. In this Pit they Fiſh under ground, which is a Curioſity not unpleaſant, and differing from all the reſt. For there is in the bottom a great Hole in the *Stone*, by which Men may eaſily go down with Lighted Torches, as into a deep Ciſtern; and there is under a large Cavern like a Vault, the Bottom or Pavement whereof is as it were a Sieve full of little Holes, whereby the *Water* runs away leaving the *Fiſh* dry, where they are Caught.

10. The Pit *Rethje* is empty two Hours after *Ribeskajamma*, and is of no great Conſequence for Fiſh: An Hour after this, the Pit 11 *Sittarza*, and in 5 or 6 Hours more 12. *Lipaoza* falls Dry.

13. The 3*d* Day after *Reſcheto* the Pit *Gebno* is Evacuated; in this they rarely Fiſh with Nets, but let fall Dry, and the Holes in the Bottom being ſo ſmall, that they exceed not the ſize of a Man's Arm, all the great Fiſh are left behind in the Pit.

14. Two days after *Gebno* the Pit *Koteu* becomes dry: In this they ſometimes take the Fiſh as in the former, but the Holes being greater let bigger Fiſhes paſs.

15. The Pit *Ainz* empties 4 or 5 Hours after *Koten*: In this they ſeldom (unleſs they cannot help it) let the Water run away without uſing their Nets, as in *Gebno*; becauſe of one great Hole in the bottom whereby many great Fiſhes may eſcape.

16. The Pit *Zeſlenza* ſinks three Hours after *Ainz*; in this they always *Fiſh* with *Nets*. As in

17. *Pounigk*, which is emptied the next Day after *Kotou*.

18. The laſt Pit called *Leviſche* is Evacuated the third Day after *Pounigk*, that is the 25th Day from the beginning of the Receſs of the Water of the Lake, ſo that in 25 Days the Fiſhing of this Lake is over. In this laſt Pit about 17 Years ſince, I am certainly informed, that there fell a Flaſh of *Lightning* about the time of *fiſhing*, which ſtunned a great Multitude of large

Fiſhes, ſo as that they filled 28 *Carts* with them: (By a *Cart* is meant as much as one Horſe can draw.) Theſe Fiſh are not properly *Thunderſtruck*, but only ſtunned with the Violence and Sulfureous Vapour of the Lightning, which makes them riſe and Swim as Dead upon the Top of the Water; but if they be taken up and put in Freſh Water, they ſoon recover, otherwiſe they die. This is no uncommon Accident in this Lake.

The Fiſhing being thus ended, a Sign is given by tolling the Bell in the Chappel of St. *John Baptiſt*, near the Town of *Cirknitz*. Upon which all the Inhabitants of the Neighouring Villages and of *Cirknitz*, without regard either to Age or Sex, go for the moſt part ſtark Naked, into the Lake, and look for Fiſh among the Weeds and Sedge, and in the ſmaller Pits. And many creep into the Subterraneous *Caverns* and Paſſages, and find ſtore of large Fiſhes there. They having full Liberty to ſearch all over the Lake, excepting in the Pits *Pianze*, *Narte*, and *Velkjoberth*. This Barbarous and Immodeſt Cuſtom of going Naked, has been often attempted to be reclaimed by the *Carthuſian Monks*, but all in vain, for ſo prevalent is a Habit of vicious Practices over good Precepts, that they have not yet been able to perſwade them ſo much as to cover their Secrets.

There are beſides theſe ſome other Pits in the Lake, as *Skednenza*, *Mala* and *Velkabobnarza* in which they Fiſh likewiſe, as alſo in *Mala-karlouza* and *Velka-karlouza*: In both theſe they go far under ground with lighted Torches, and find Fiſh, but theſe Pits are of no great value. In *Velkabobnarza* one may go in at great Holes, and deſcend many Fathoms under ground. Theſe two Names *Velka* and *Mala-bobnarza*, ſignifie in the *Carniolan* Tongue the greater and leſſer *Drummer*; nor is it without Reaſon that theſe Pits are ſo called; for when it *Thunders* and *Lightens*, there is heard in theſe two Pits, as it were, the Sound of many Drums beating, which *Anno* 1685 I heard with my own Ears; it Thundring 3 Times ſucceſſively, and the Sound of Drums anſwering accordingly.

The two Pits *Narte* and *Pianze*, are never emptied, but always remain *Fenny*, when the reſt of the Lake is quite dry. It is believed that in theſe Pits the Fiſh lay their Spawn, and therefore it is prohibited to Fiſh in them. In them is an incredible Number of *Horſeleeches*, which according to the vulgar Opinion, underſtand certain Words; for that upon repeating them, they will come in great Parties towards him that repeats them, whereas if he be ſilent, very few of them will touch him. Theſe *Horſe-leeches* often ſtick upon the People in the Fiſhing Time, (ſome of them being diſperſed all over the Lake) and the Method they take to get them off, is to get ſome other Perſon to piſs upon the *Leech*, which makes it let go its hold; and this without any reſpect to Modeſty, is practiſed as well upon the *Women* as *Men*.

There are in the Mountain nigh the Lake, but ſomething higher than it, two great and terrible ſtony *Caves*, the one called *Vrainajamma*, the other *Sekadulze*, which tho' far diſtant one from the other, have yet the ſame effect, *viz*. When it *Thunders* and *Lightens*, theſe two *Caves* do *Emit-Water* with a wonderful and incredible force, and with it ſometimes a great quantity of *Ducks*, with ſome Fiſh, which I my ſelf obſerved in *October* 1685, not without our great danger of my Life. I took my Horſe and rid croſs the Lake as far as the Iſland *Vornek*, in company with two old experienc'd *Fiſhermen*; when ſuddenly the *Cavern* in the mountain *Slivenza* began to breath forth miſty Vapours, forming a Cloud. Upon which my *Fiſhermen* adviſed me to make haſte, for without doubt thoſe Clouds would produce a *Tempeſt*. They had ſcarce ſaid ſo, when it began to lighten and thunder dreadfully; and I had difficulty to perſwade them to accompany me as far as the Pit *Velkabobnarza*, being deſirous to examine what is ſaid of it, that when it thunders, the *Sound* of many *Drummers* is heard in it. This I found 3 times to ſucceed as reported, and then with all the Speed we could, we haſted to the Iſland *Velkagoriza*, not being able to go farther, becauſe the Water was in many places grown out of our depth, where two Hours before we had paſſed dry. Here we got one of the little *fiſher-boats*, which when the *Lake* is dry, lie diſperſed here and there on the bottom; and having got in my Horſe, we began our Voyage, but had the ill luck to over ſet our Boat, and ſo were obliged to ſwim for't, and with much to do arriv'd ſafe on the other *Shore*. Then we could ſee from the other ſide that the *Water* guſhed with great *Impetus* out of the Cave *Sekadulze*, being caſt 3 or 4 Fathom, as if it were forced by a *Fire-Engine*, and ſeveral blind *Ducks* were thrown out by the *Water*. It is not to be wondred that the *Lake* fills ſo faſt, for conſidering the Violence wherewith the *Water* ruſhes, it is as much as a great *River*; this Cave *Sekadulze*, being a Fathom wide, and higher than a Man. It is look'd upon as a dangerous thing to enter into this Cave, becauſe the Water comes ſo all on a ſudden, that if it ſhould chance to come it is impoſſible to eſcape it.

When it rains moderately, the *Water* ſpouts with great violence two or three Fathoms perpendicularly, out of the Pits *Koteu* and *Zeſlenza*. It comes likewiſe forcibly out of the Spring *Treſenz*, as likewiſe out of *Velkioberch*, bringing with it at this latter abundance of *Fiſh*, and ſome *Ducks*. But when it rains very hard and long together, eſpecially with *Thunder*, then the *Water* breaks out with very great force, not only from all the aforeſaid *Pits*, *Holes* and *Caves*, but likewiſe at ſeveral thouſand other little *Holes*, which are all over the bottom of the *Lake*, and which when the *Lake* is dry, drink up the *Waters* of the 8 Rivulets that run into it, ſpirting ſeveral Fathoms high, from ſome perpendicularly, from others obliquely, ſo that there is not a pleaſanter Sight than this. And out of the *Pits Vodonos*, *Reſcheto*, and ſome others, having great *Holes* at the *Bottom*, there comes with the *Water* a great quantity of *Fiſh*. In caſe of great Rains, the 8 *Rivulets* are likewiſe much increaſed, ſo that all things concurring, this Lake in 24 Hours time, will, from quite dry, be full of *Water*, and ſometimes in 18 Hours; tho' at other times, it has been known to be 3 Weeks in filling. But it is a conſtant Obſervation, that *Thunder* and *Lightning* help much to fill it ſpeedily

This Lake being thus by turns wet and dry, ſerves the Inhabitants for many purpoſes. For 1*ſt*. while it is full of *Water*, it draws to it ſeveral ſorts of *Wild-geeſe*, and *Ducks*, and other *Water-Fowl*, as *Herons*, *Swans*, and the like, which may be ſhot, and are very good Meat.

Next, as ſoon as the Lake is emptied, they pluck up the *Ruſhes* and *Weeds*, which make excellent *Litter* for *Cattle*. 3. Twenty days after it is fully dry they do cut a great quantity of *Hay* upon it. 4. After the *Hay* is in, they plow it and ſow *Millet*, which ſometimes by the too ſudden coming of the *Water* is deſtroy'd: But it generally comes to Maturity. 5. While the *Millet* is on the ground, they catch a great Number of *Quails*. 6. The *Millet* being in, there is good Paſture for Cattle. 7. When the Lake is dry, there is great variety of hunting; there coming out of neighbouring *Woods*, and *Mountains*, plenty of *Hares*, *Foxes*, *Deer*, *Swine*, *Bears*, *&c.* ſo ſoon as the Water is gone. 8. When it is full one may fiſh in it. 9. In *Winter-time*, it will be ſo firmly frozen, as to bear all ſorts of Carriages, and is a great convenience to the People to fetch their Wood and other Neceſſaries. *Laſtly*, At the Time when the *Water* goes away, it yields great abundance of Fiſh, as hath been already ſaid. And that which is moſt wonderful is, that all this comes to paſs in the ſame place, and the ſame Year, *viz.* If the Lake be early dry, and it fill not too ſoon; but it is to be noted, that the Hay does not grow, nor is the *Millet* ſoon all over the Lake, but only in the more fertile Places.

There are only theſe ſorts of Fiſh taken in this Lake, which are very well taſted, They are the *Muſtela fluviatilis*, or *Eel-pout*, ſome of them weighing 2 or 3 Pounds; 2. *Tench*, ſome of them weighing ſix or ſeven pounds. And 3*dly*, *Pikes* in very great plenty, of 10, 20, 30, and ſome of 40 Pound weight, in the Bellies of theſe it is common to find whole *Ducks*; *Crabs* are found no where but in the *Pits Kamine* and *Sueiuskajamma*: They are large but ill taſted.

The *Cauſe* or rather *Modus* of all theſe wonderful *Phænomena* in the Lake of *Zirchnitz* is, according to my Opinion and Speculations, as followeth; there is under the *Bottom* of the *Lake*, another ſubterraneous one, with which it communicates by the ſeveral *Holes* deſcribed. There are alſo one or more *Lakes* under the *Mountain Javornik*, but whoſe ſurface is higher than that of the *Lake* of *Zirknitz*. This upper *Lake* is poſſibly fed by ſome of thoſe many Rivers, which in this Country bury themſelves under Ground, and has a Paſſage ſufficient to carry the *Waters* they ordinarily bring into it: But when it rains, eſpecially in *Thunder-ſhowers*, which are the moſt haſty, the Water is precipitated with great Violence down the ſteep Valleys, in which are the *Channels* of theſe *Rivulets*, ſo that the Water in this Lake being increaſed by the ſudden coming in of the Rains faſter than it can empty, ſwells preſently, and finding ſeveral Holes or Caverns in the *Mountain* higher than its ordinary ſurface, it runs over by them both into the *ſubterraneous Lake*, under that of *Cirknitz*, into which the *Water* comes up by the ſeveral *Holes* or *Pits* in the *Bottom* thereof, as likewiſe, by viſible paſſages above Ground, ſuch as *Vrainajamma*, *Secadulze*, and *Treſenz*.

That ſome of theſe Paſſages bring *Fiſh*, ſome *Ducks* and *Fiſh*, others only *Water*, ſeems to depend on the *Poſition* of the inward Mouths of theſe *ſubterraneous Channels*, for if they be ſo conſtituted, as to draw off the *Water* from the Surface of the upper Lake on which the *Ducks* ſwim, they muſt needs be drawn away by the Stream into theſe *Caverns*, and come out with the *Water* : But if ſo that the *Channels* open into the upper *Lake*, under the ſurface of the *Water*, and from thence aſcend obliquely for ſome ſpace before they come to deſcend, then the Water they carry is drawn from below the ſurface, and conſequently can bring with it no *Ducks*, but only *Fiſh*. Thoſe *Pits* which yield only *Water*, may well be ſuppoſed to be fed by Paſſages too narrow to let the Fiſh paſs, tho' their multitude may make the Quantity of Water they emit to be very conſiderable.

The manner of the *falling away* of the *water* or *emptying* of the *Lake*, I thus explain. After a long Drought or want of *Rain*, all the Springs that feed the upper Lake under *Javornik* are much diminiſhed ; ſo that wanting freſh Supplies, it ceaſes to run over by the ſeveral Channels but now mentioned : Hence the Lake of *Zirknitz*, and that under it, are fed only by the 8 Rivulets that always fall into them, and then the *Water* draws off faſter than it comes in, both by the Channels of *Mala* and *Velka-karlouza*, as alſo by a concealed ſubterraneous Paſſage out of the under Lake, which latter alone is able to tranſmit more Water than the ſaid 8 Rivulets afford. Conſequently the Lake muſt ſink, and that in a certain proportion of Time, depending on the Quantity of Water to be evacuated, compared with the Exceſs of that that runs out, above that that enters it in the ſame time. 1. Thoſe *Pits* that are higher are ſooneſt dry, the lower lateſt, and ſo come to be emptied in the Order above deſcribed, and when the Lake is all dry, then the ſaid Rivulets ſoak by ſeveral little Holes in the *Bottom*, into the under Lake, and all their Water is carried away by the aforeſaid *ſubterraneous Paſſage*.

That there is ſuch a *Paſſage* is very evident, and that it communicates under Ground with the Channels of *Mala* and *Velka-Karlouza*, coming out with them, as hath been already ſaid, near St. *Cantian* at a Rocky *Cave*, and making the River *Jeſero* : For when the Lake of *Zirknitz* is very full, and runs out of both *Velka* and *Mala-Karlouza*, the River *Jeſero* at St. *Cantian* overflows, and runs with great Violence ; when it only runs out at *Mala-Karlouza* (which is ſomewhat lower than the other) then the Water of *Jeſero* is much leſs rapid ; but when the Lake is ſo fallen, that it runs out at neither of the two, the River *Jeſero* is ſtill leſs, but runs with a conſiderable Stream, till 2 Days after the Lake has been dry ; after which, the ſaid River becomes little, voiding no more Water than the Lake receives from the 8 Rivers that run into it : By which it is clearly proved, that this *ſubterraneous Paſſage* does meet with the Channels of *Velka* and *Mala-Karlouza*, and needs no farther Illuſtration.

Hence it appears, why this Lake ſometimes is twice or thrice dry in a Year, at other times continues full for 3 or 4 Years together, but was never known to be dry for a whole Years Time ; for it falls dry at any Time when there falls but little Rain in a long ſpace of time ; and in rainy Years it continues always full ; but it never happens in this Country, that there is a Drought for a whole Year together.

The

The *Ducks* I have ſo often mention'd, and which are caſt out with the *Water*, are generated in the *Lake* under the Mountain *Javornik*; when they firſt come out they ſwim well, but are ſtark blind, and have no *Feathers* on them, or but few, and therefore are eaſily caught; but in 14 days Time they get *Feathers*, and recover their Sight yet ſooner, and afterwards fly away in Flocks. They are black, only white on the Fore-head, their Bodies not big, reſembling ordinary *Wild-Ducks*, and are of a good Taſte, but too fat, having near as much Fat as Lean.

I kill'd ſome of them as ſoon as they had been caſt out at *Sekadulze*, and opening their Bodies, I found in them much *Sand*, and in ſome few, ſmall Fiſhes, in others green ſtuff like graſs or herbs which was the more ſtrange, becauſe I never found any green Thing growing in any of our *ſubterraneous Grottoes* or *Lakes* in *Carniola*; I tried alſo to procure ſome of the Fiſh at the Time of their being caſt out, to open them, and ſee what they live upon, but notwithſtanding all my Endeavour, I could not get any of them to ſatisfie my Curioſity withal.

Almoſt every Year at a Hole in the *Mountain* called *Storſeg*, about half a *German* Mile from the Lake of *Zirknitz*, near the Town of *Laas*, whenever there happen great Floods of Rain, this ſort of *Ducks* is caſt out in great Abundance, by the Water Guſhing out with much Force. I conceive that this *Cavern Storſeg* is another Paſſage out of the ſame Lake under *Javornik*, that overflows and fills up our Lake of *Zirknitz*; but this being ſomewhat higher, it never runs out unleſs the ſaid *Lake* be more than ordinary ſwelled by the Violence of the Rains. The caſting out of great Numbers of *Ducks* here, is ſo common, that it is look'd upon as no Rarity.

It may ſeem ſtrange and hard to believe that there ſhould be ſuch *ſubterraneous Lakes* and *Channels* as we may ſuppoſe; but beſides that, without them it would be impoſſible to account for all theſe ſeveral Effects which are moſt true, and which I my ſelf have obſerved: There is a moſt notable Inſtance of the like Things found in the *ſubterraneous Cavern* called the *Grotto Podpetſcbio*.

Fig. 3. This *Grotto* is in *Carniola* in the Pariſh of *Guetenfeld*, diſtant four *German* Miles from the City *Labac*. *a*, is a Hole or Entrance into the rocky mountain; *b*, is a great *Cavern* in the Mountain, capable to hold above a hundred Horſemen; *i*, *k*, is a Channel big enough for a Man to paſs by, as far as the Lake *o*, out of which Lake the Inhabitants hereabouts draw all their Water, having none nearer, and fetch it with lighted Torches. Into this Lake *o*, the Water runs with a great Stream by the *Channel l*, and out of this Lake it falls down a Precipice into a great Cavern, with ſo much Noiſe, that the diſcharge of a Piſtol would not be heard here. There is likewiſe another Channel *m*, which tends upwards obliquely, and leads to the great Lake *n*, whoſe Length and Breadth are hitherto undiſcovered; I look'd about it with many Lights, and could ſee nothing but Water, and throwing Stones ſeveral ways as far as I could, I heard them all fall in the Water: And I found the Depth of it near the Bank to be ten Cubits, and doubt not but it is much deeper in the middle.

The Country People told me, that this Channel *l*, affords always an equal quantity of Water, or elſe is quite dry; and that ſometimes it will ceaſe to run in a Moment, and continue dry for ſome Weeks, and then on a ſuddain it will run again with great force, ſo as the Noiſe thereof frequently frights the People as they come for Water.

Out of the Cave *b*, there is another Channel *c*, which is divided into three others *d*, *e*, *f*. This Channel *f*, tends obliquely downwards, till it comes to a running Water in *g*, from whence one may go on to *h*, where looking thro' a little Hole, one may ſee another little Lake.

All the Channels I have mentioned, are formed in a very hard Rock, and are ſmooth or poliſhed, as if cut by Mens Hands. Theſe may be ſeen by any one that will go with lighted Torches; and there are many ſuch in which I have not been.

If any one would carry a Boat to the Lake *n*, and would row upon it, I doubt not but he might find ſeveral curious things. I believe this *Subterraneous Lake* to be a *German* Mile long: For from this *Grotto Podpetſchio*, at a Miles diſtance, there is a Village called *Kompale*, whoſe Inhabitants have no other Water, than what they fetch out of a Hole in the Rock, going with lighted Torches, by a large Channel, to a great Lake under ground. I meaſured with good Geometrical Inſtruments, ſuch as Miners uſe, the Level of theſe two Lakes of *Podpetſchio* and *Kompale*, and found them to be in one *Horizon*; and this I did twice, both when the Channel *l*, at *Podpetſchio* Run, and when it did not Run. When it began to Run, I found that the Lake *n*, was two Cubits higher than it had been before; when it ceaſed to Run I came again on purpoſe to obſerve it, and found that then alſo, the other Lake at *Kompale* was in the ſame Level; from whence it is moſt certain, that theſe two, are only one continued *Subterranean Lake*.

XX. The Lake of *Geneva*, which is one of the moſt pleaſant Places of the World, lies like a *Croiſſant* of Water, one Extremity whereof is 18 Leagues diſtant from the other, and the Banks of which are gently raiſed to ſome heights, then to Collines, at length to ſtupendious Mountains; which yet are not ſo linked to one another, but that they leave betwixt them Interſtices of 15 or 20 Leagues Proſpects, checkered by Meadows, Corn-Fields, Orchards, Vines, Foreſts of Firr-Frees, Snow lying on the ſides of the Rocks. All thoſe Objects, which at a diſtance are confounded, and ſeem to make but one, have near Hand their ſeveral Beauties. That Point where *Geneva* ſtands, is ſomewhat longer and more extended than the other. This *Croiſſant* where 'tis largeſt, which is from *Morges* to *Thonon*, is about 5 good Leagues over.

The Lake *of* Geneva; *By* n.86.p.5043

The Water of this Lake is very good to drink, and even ſo Limpid, that even in the rolling of the Waves, which ſometimes go high enough, the Water is not troubled but along the Banks. And if one do attentively look down from the Caſtle of *Chilon*, or from any of the Neighbouring heights, into the Bottom of the Lake, he may ſee high Mountains under the Water. And the Water is ſo Deep before *Veuvay*, that the Sounding Line at the end of 400 *Fathoms*, ſeems, becauſe it will not ſtay, to touch upon ſomething

Slippery. 'Tis held to be 500 *Fathoms* deep before *Roole*; and 'tis affirm'd, that near this great Depth there may be ſeen a kind of Iſle under Water.

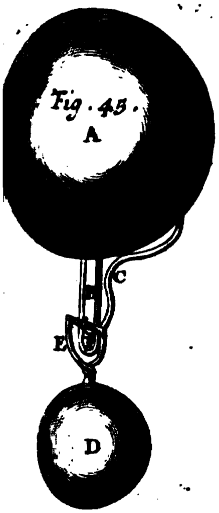
The *Rhone* enters at one of the Points of the *Croiſſant* into the Lake, and iſſues out at the other; but with this Difference, that whereas he comes in Dirty and Miry, he ever goes out ſo Pure and Clear, that under the Bridge of *Geneva*, where the Water is deep 25 Feet in Summer, you may well diſcern the ſmalleſt Stones at the Bottom. And the ſame Water, which in this Place appears of a *Sapphyrine Blew* in the Shade of the Houſes, appears altogether *Green*, nor is ſo Tranſparent, when the Sun Shines on it.

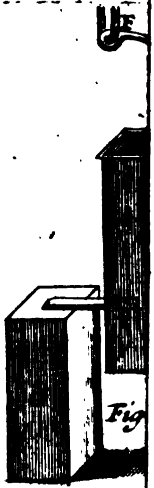
Having heard the Sentiments of the Curious of *Lauſanne* and *Geneva*, and the Opinions of the moſt knowing Fiſhermen, that are there in great Number, and eſpecially at *Coupet*, I believe with the latter, that although the *Rhone* entering into the Lake loſeth its Violence, yet doth he ſtill keep ſome ſenſible Motion in ſome Places, and every where obſervable, and that no *Trouts* are taken any where in this Lake but in this *Current* of the *Rhone*.

The Water of this Lake commonly begins to Encreaſe about the end of *January*, or the beginning of *February*, and continues to do ſo unto the 20*th* of *July*, and often unto the very Month of *Auguſt*; and then it inſenſibly Decreaſeth, ſo that the Water is leſs high in Winter than Summer, by 12 or 15 Feet. About this Increaſe of the Water there are different Opinions; 'Tis true, they all believe in general, that the principal Cauſe of the Increaſe of the Water is the melting of the Snow, and of the Mountainous Ice, that is in the Winter formed of the Waters of the Springs, and Torrents which the Froſt fixeth. This is ſo true, that when there is much Snow in Winter, the Waters are very high the enſuing Summer. But when great Rains chance to fall in *January*, then the Snow, not yet being well hardned, Melteth on a ſudden altogether: And when this Melting is not ſo violent, all the Snow, that will melt, melts at the end of *May* or the beginning of *June*, ſo that, there remaining but the Stock of Ice for entertaining the Increaſe of the Water unto the Month of *Auguſt*, ſome have thence been induced to aſſign other Cauſes.

At the Iſſuing out of the Bars, that from *Geneva* on the ſide of the Lake, are ſeen in the Water two or three huge Flints ſtanding out of the Water, the chief of which they call *Niton*: And the Tradition is, that it formerly was an Altar conſecrated to *Neptune*, there being alſo a place cut out in the middle, which they take to have been the Place for the Sacrifice. On this Flint 7 or 8 Perſons can ſit; and ſometimes, when the Waters are very low, there are found about it Knives, and Needles, as thick as Bodkins of Tweezers, and much longer; both of Braſs, well enough made, and eſteemed for to have ſerved for the Sacrifices.

This Lake in Serene and Calm Weather appears ſometimes, and that even before Sun riſing, as if it were made of divers pieces differently coloured; part of it being Browner than the reſt: Which ſeems to be cauſed by a Breath of Wind paſſing thorow the Water, coming either from the bottom of the Lake or from above; though others think this gentle Agi-





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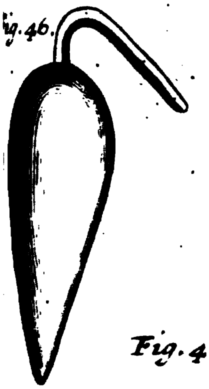


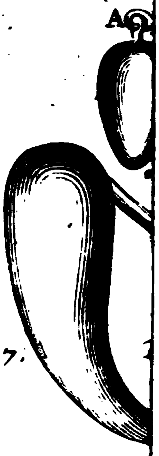
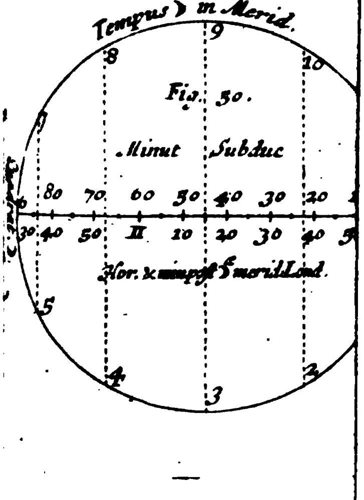


Fig. 47.



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tation to proceed from ſome Springs that are at the bottom, making the Water Shiver above. But that part of the Water, that is not moved, appears as even and ſmooth as a Looking-Glaſs, or like Water traced by a Ship. And as for the Colours, they are in my Opinion, an effect of the Neighbouring Mountains, the different Images of which, being confounded in the Water, make an appearance of very Pale Colours.

After that the *Rhone* is entered into the Lake, he retakes not his impetuous Courſe before a Quarter of a Miles diſtance from its coming forth again, that is, above *Geneva*. And the nearer he comes to that Town, the more his Bed becomes narrow, and conſequently his Courſe more Rapid. Yet this Rapidneſs hath been in our times once Surmounted by Wind, and once by Water.

In the Winter of the Year 1645. there aroſe in the Morning about 9 a Clock ſo furious a Wind, that not only it uncovered the Houſe, but alſo laid dry the Bed of the *Rhone* above the Bridge, ſo that many, in the view of all the Town, croſſed quite over it (to the little Iſland) dry Foot, and one of the Sons of M. *D'Aubigny* took up ſome Medals, which he found in his way. This paſſage was free during an Hours time, at the end of which the River retook its Courſe. At that Seaſon the Water being very Low, and a Weſt Wind, to arrive at *Geneva*, being preſſed by the high Mountains, that bring it upon the Town as by the Noſe of a Pair of Bellows, it came to paſs, that that Wind did violently bear upon the Water near the Bars, keeping ſuſpended the Water that was beyond, and thoſe Waters that were beneath running away downwards by a Declivity, and under the Shelter of the Houſes. Whilſt I was Scrupling at this Relation, they brought me *Gallaſius* his Commentary upon *Exodus*, Printed 1560; where 'tis recorded that the like Accident had fallen out at *Geneva* at the time when that Miniſter lived there, a South-Weſt Wind having made the *Rhone* to Recoil into the Lake, and many People having thereupon paſſed over dry for an Hours time.

Concerning the other Accident; you may remember that the River *Arve*, which is a kind of Torrent, falls into the *Rhone*, about 1000 paces beneath *Geneva*. In the Month of *December* in the Year 1652. the ſaid *Arve* did ſo extraordinarily Swell, that not only it over-run its Banks with Impetuoſity, but alſo interrupted the Courſe of the *Rhone*, and forced it to re-enter into the Lake for the ſpace of 14 Hours.

This Lake doth very much abound with Fiſh, which have as 'twere Cantoniz'd themſelves, and divided the Lake amongſt them. The Trouts are not to be found there, but, as hath been already mentioned, in the Current of the *Rhone*; the *Carps* have taken up their Quarters towards *Veuvay*; the *Pikes* and *Pearches* have alſo their Habitations a part: But ſome other Fiſh that are but Paſſengers, not living conſtantly in the Lake, ſpread themſelves almoſt every where indifferently. The great *Trouts* paſs out of the Lake for 4 Months of the Summer, and are taken in Autumn when they are returning thither. The Fiſhing is farmed out at *Geneva*; and there are Conſervatories, where many of theſe big *Trouts* are kept, among which there are ſome that weigh Fifty Pounds. Sometimes they catch *Pikes* there of 80 Pounds Weight; and a Pound Weight at *Geneva* you know to be 18 Ounces.

In the Months of *July* and *Auguſt* they Fiſh for the Fry of *Pearches*, at a time when they are no bigger than the ſmalleſt taggs. Theſe are a very Delicious Diſh there called *Mille Cantons*.

The Lake Avernus; By *Dr.* Tancred Robinſon. n. 172 p. 1038

XXI. I have ſeen many Water-Fowl Feeding upon and Flying over the Lake *Averhus*, reported by many of our own, as well as foreign Writers, to Kill Birds at a diſtance. I obſerved ſeveral Land Fowl alſo to Fly over that Lake, without the leaſt Diſturbance, from all ſides, and ends. But peradventure the Poyſonous Steams (if there are any peculiar to that Lake) ſometimes Vaniſh, and Return again; or elſe may be alter'd by new *Effluviums* intermingled with them.

The Lake of Mexico, *By* . . . . . n. 130. p. 758.

XXII. The Lake of *Mexico* hath this of extraordinary, and perhaps peculiar, that part of its Water is Sweet, and the other part Salt; which make it believed to be derived from two Sources, whereof the one holds Sweet Water, the other comes from ſome Mineral and *Saline* Earth found in the Hills through which this *Water* paſſeth, and is impregnated with the *Salt* which is diſſolved in its Courſe: Or if it have no peculiar Source, it muſt be, that that which makes part of the Lake *Salt*, is the *Bottom* or the *Earth* under the *Water*, being in that place full of *Salt*; which is confirmed by Experience, much *Salt* being made of it every Day, of which that City drives a great Trade with remote Parts even the *Philippines* themſelves, whither it is tranſported in conſiderable Quantities. That part of the Lake which is Sweet, is Still and Quiet; the *Salt* part is Agitated and moved according as the Winds blow. The Sweet Water is very good and Wholeſome, breeding plenty of little Fiſhes; that which is moved is, *Bitter-Salt*, breeding no Fiſh all. The *Sweet Water* is higher than the other and falls into it. The *Water* of the *Salt* part is 7 Leagues long, and as many Leagues broad, and hath above 22 Leagues in Compaſs; that of the *Sweet Water* is near as big; and the whole Lake contains about 50 Leagues in Compaſs.

An Inland Sea near Dantzick, *Yielding in Summer a* Poiſonous ſubſtance; *By* M. Kirkby n. 83. p. 4069

XXIII. Near a ſmall Village call'd *Tuckum*, 2½ *German Miles* diſtant from *Dantzick* Weſtward, there is an *Inland-Sea* (made by the meeting of 3 Rivulets, ſome Springs from the adjoyning Hillocks, and the Deſcending Rain and Snow-water) of about half a *German Mile* long and an eighth part of ſuch a Mile broad. The Soil of the ground round about ſeems to be Sand mixt with Clay. Its Shore generally Sandy, as is its *Bottom* alſo. Its depth where deepeſt, four Fathoms; but for the moſt part but one, or one Fathom and a half. 'Tis ſtored with wholeſome and Delicate Fiſh, as *Pearch*, *Roch*, *Eels*, *&c.* and famed for a ſmall Fiſh much eſteemed here, and not much unlike a *Pearch*, only not ſo party coloured, and having a larger Head proportionable to its Body called the *Cole perch*. The *Water Sweet* and *Wholeſome*; but only in the *three* Summer *Months*, *June*, *July*, and

Auguſt, it becomes every Year, during the dry Weather, Green in the middle with an *Hairy Efflore ſcence*; which *Green Subſtance*, being by ſome violent Wind forced aſhore, and with the Water drunk by any Cattle, Dog, or Poultry, cauſeth certain and Suddain Death; whereas at the ſame time, that a knowing and Ingenious Perſon (who firſt acquainted me with it,) ſaw three Dogs killed with it, the Horſes that were ridden into the *Water* beyond the place, where this *Green Subſtance* Floated, drunk without any Hurt; and that alſo, during the ſame Seaſon, the *Water* in the Streams, that Flow from it, are *Wholeſome*.

Some Extra-ordinary Lakes in Scotland, *By Sir* Geo. Mackenzy. n. 114. p. 307.

XXIV. 1. There is a little Lake in *Straherrick* on the Lord *Lovel's* Lands, which never Freezes all over (even in the moſt vehement Froſts) before *February*; but one Night's Froſt thereafter will Freeze it all over, and two Nights then will make the Ice of a very conſiderable thickneſs. I have heard of two other Lakes, one of which, is on Lands belonging to my ſelf, called *Loch Monar*, of a pretty largeneſs, which ſteddily keeps the ſame Method. There is another little Lake in *Straglaſh* at *Glencanich* on Lands belonging to one *Chiſſolm*; the Lake lies in a bottom 'twixt the Tops of a very high Hill, ſo that the bottom it ſelf is very high. This Lake never wants Ice on it in the middle, even in the hotteſt Summer, though it Thaws near the Edges: And this Ice is found on it, though the Sun, by the reaſon of the Reflexion from the Hills, in that Country is very Hot, and Lakes lying as high in the Neighbourhood have no ſuch Phænomenon. 'Tis obſervable alſo, that about the Borders of this Lake the Graſs keeps a continual *Verdure*, as if it were in a conſtant Spring, and Feeds and Fattens Beaſts more in a Week than any other Graſs doth in a Fortnight,

Our famous Lake *Neſs* never Freezes; but on the contrary in the Violenteſt Froſts, the greater Clouds of Steams do ariſe from it. And I remember, that at two ſeveral times, I being at *Inverneſs*, walking in the Evenings along the Bridge over the River *Neſs*, a Miſt of thoſe Steams coming from the Lake and falling down to us over the River (for there was no Miſt in any place thereabout but on this Lake and River only.) our Hair became all white, like the whiteneſs of a hore Froſt, but it was ſoft and warm; and this was in the midſt of Summer and in warm Evenings. Dr. *George Mackenzy* (who lives at *Inverneſs*) told me, that he obſerves *Roſemary*, though uncovered, to continue in the Gardens about that Lake's ſide, notwithſtanding the laſt Winter's long and Violent Froſts; whereas a far leſs violent Winter ordinarily kills all the *Roſemary* which is in Gardens that lie in warmer places, and at the Sea-ſide: And though I live near it, and in a better Soil and warmer Situation, yet any *Winter*, more than ordinary Cold, kills my *Roſemary*, though covered over with *Straw* and *Litter*. This he attributes (and, I think on good ground) to the warmth occaſioned by thoſe *Steams* that frequently ariſe from that *Lake*.

In *Glevely* at a place called *Achignighium*, there is a little Rivulet, which ſo turns *Holly* into a *Greeniſh Stone*, that they ordinarily make Moulds of it for caſting of Balls for Fuſees; and Tinkers that work in Braſs make both their Moulds and Melting *Pots* of it; and *Women* their round Wharls for Spinning.

ning. May it not be, that by the long Infuſion in *Water*, deſcending from Hills, which perhaps abound in Marle, capable to be reſolved into ſmall particles by the conſtant waſhing of the *Water*, may it not be, I ſay, that theſe little Particles do Intrude into the Cleanſed Pores of the *Holly*, and ſo make up that *Soft Stone*? And any thing Ligneous remaining of the very hard Timber, being all incruſtated with this Marle, may it not thereby be guarded from the Action of the Fire?

By Mr. Ja. Fraſer. n. 254. p. 230.

2. The Lake *Neſs*, according to Highland Tradition and Bards, has its Name from one *Nyſus* an *Iriſh Hero* that fix'd a Colony in *Stratharig*, with *Dornadillo* his Wife. The Promontory, upon which he had his Reſidence, is to this Day call'd *Doun Dearnill*; and he being the firſt that ever offered to ſet out Boat or Barges upon this Lake, it is after him called *Loch-Neſs*. It is 24 Miles in Length, and in moſt places two in Breadth. One *George Scot*, tried 500 Fathoms, and Capt. *Orton* a whole Barrel of Plum-line, but found no *Bottom*. The Banks of this Lake aſcend high and Mountainous, with *Woods*. The Lake never Freezes, which is imputed to the many great Springs and Fountains in it; the only Fiſh in it is *Salmon*. This Lake *Neſs* diſcharges it ſelf in a River of the ſame Name, ſix Miles in Length, which runs ſlowly yet never Freezes, but ſtill Smoaks with Froſt: And from this Smoak is ſpread a Fog over all the adjacent Country.

On the ſide of *Loch Neſs* ſtands the famous Caſtle of *Urqhart* upon a Rock; the great Ditch round it was for the moſt part cut out of the Rock, and received the *Water* of the Lake. This Caſtle conſiſted of 7 great Towers, and 'tis ſaid was built by the *Cuminees*, but had its Overthrow by King *Edward* the Firſt of *England*; and nothing remains now but one Tower to the Eaſt.

To the *Weſtward* of this Caſtle about 4 Miles, upon the ſide of *Loch Neſs*, ſtands that great Mountain *Meal fuor vouny*, of a round, neat, high Shape; it will be two Miles of Perpendicular height from the Lake. Upon the very Top of this Hill there is a Lake of Cold Freſh Water, about 30 Fathoms in length and ſix broad, no Courſe or Stream running to it or from it. I plum'd with 100 Fathom of ſmall Line but could find no Bottom. It is always Equally full, and never Freezes.

About 23 Miles Weſt from the End of the River of *Neſs*, there is a Foreſt called *Aſſaruck*, in which there is a Mountain call'd *Glenin-Tea*; and on the North ſide, under the Shade of a great ſloping Rock, ſtands a Lake of Freſh Water, call'd *Lochan Wyn*, or *Green Lake*, 18 Foot in Diameter, about a Fathom Deep. This Lake is always cover'd with Ice, Summer and Winter.

Lough-Neagh *in* Ireland, *by* Mr. Will. Molyneux. n. 158. p. 552.

XXV. 1. It is generally agreed by all the Inhabitants thereabouts that *Lough-Neagh* has a Petrefying Quality: But that no Wood will Petrefy in it except *Holly*. It is alſo aſſerted with ſome probability, that the Earth about the *Lough* has this Petrefying Quality: For I am certainly informed, that a Gentleman of the Country about this *Lough*, a little before the Rebellion, cut down ſome Timber for building, and amongſt others cut down a large *Holly* Tree, but being diverted by the Rebellion from building, his

Timber lay on the Ground in the place where it was fell'd, upon the Banks of the *Lough*, all the Miſerable time of the War, till at laſt the Kingdom being ſettled, the Gentleman went to look for his Timber, and found the other Timber overgrown with Moſs, and the *Holly* Petrefy'd, tho' the Water of the *Lough* had never reach'd it.

And perhaps the *Holly* it ſelf, that grows upon the Banks of this *Lough*, may be more apt to be Petrefy'd, than the ſame Wood growing other where; and brought thither, and put into the *Lough*, for certainly if the Gound has this Quality, this is very likely to follow.

That what we call *Lough Neagh Stone*, was once *Wood*, is moſt probable on theſe accounts. *Firſt*, It will not ſtir with *Acids*. 2. It will Burn and Flame; and the Smoak of it ſmells like the Smoak of Wood. 3. When Burnt it betrays the very Grain of Wood, with the other Veſſels belonging to *Vegetables*. 4. I have many of them of various degrees of *Petrefication*; ſome that have clearly loſt the Colour of Wood, and are become perfectly Black, and very Hard; others that are not ſo Black nor Hard; but one more eſpecially was ſent me about a Year ago, which is a Parallelopiped, of about 4 Inches long, and an Inch thick, cut, I ſuppoſe, whilſt Wood in that ſhape purpoſely, whoſe outward Coat is very Black, and ſmooth, but this is meerly ſuperficial, for being cleft longwiſe through the middle, (which it ſuffered far more eaſily than that which is more throughly Petrefy'd) I there diſcovered the whole Body perfectly of the Colour and Grain of *Holly*, for I can ſcrape it with my Nail; but what was moſt ſurprizing in it was, the diſcovery of the *Pith*, as plainly and as perfectly diſtinct in Colour and Texture from the reſt (but it alſo was Petrefy'd) as it could poſſibly have been ſeen in the Natural Wood.

I never have ſeen nor could hear of any part of the Stone in the leaſt reſembling Iron.

I have uſed ſome endeavours to procure a piece of this *Lough Neagh Stone* to which the Wood was yet faſtened, but I never could attain it, tho' ſome aſſert they have ſeen pieces two or three Foot long, with about eight or ten Inches of *Stone* and the reſt Wood. Tho' I am apt to believe this may be ſtretching the matter too far, for I conceive that that Humour that Petrefies one part, when it begins to operate, Inſinuates it ſelf ſoon throughout the whole Body.

'Tis obſerved that this Petrefying Quality is not equally diffuſed throughout the whole *Lough* (which is about 15 or 16 Miles long, and 8 or 9 Miles broad in all places) but is moſt ſtrong about that part where the *Black Water* (a River ſo called) empties it ſelf into this *Lough*, that is about the South Weſt Corner; as likewiſe it is ſaid to be more ſtrong about the Edges of the *Lough*, than further into the *Water*.

I have found upon Trial, that this Stone is not *Magnetical*, for it will not ſtir a *Needle*, or *Steel-filings*, neither will it apply to the *Magnet*, in *Powder* n.166.p.823 or *Calcined*.

Upon further Tryal I find, that though it will not apply to the *Magnet*

Crude, yet being *Calcined* it applies moſt briskly: The occaſion of my former Error being, that I did not *Calcine* it long enough.

By Mr. Edward Smith, n. 174 p. 1108.

2. No Experiment, or Obſervation yet made, (that I can hear of) can prove that this *Lough* has really the Quality of Petrefying Wood; or that the *Water* does any way help or promote the Petrefication. On the Contrary a Neighbouring Gentleman of good Credit and Worth, about 19 Years ago, ſtuck two *Holly Stakes* (a *Wood* which all agree will ſooneſt Petrefie in this *Lough*) in two ſeveral Places of the *Lough*, near that place where the upper Band enters into it; and that part of the Stake, which for ſo long time has been waſhed by the *Water*, remains there without any Alteration, or the leaſt Advance towards Petrefication. It is reported indeed that the *Water* has this Virtue, eſpecially about thoſe Places, where the *Black Water* diſcharges it ſelf into the Lake: But it ſeems evident from the very Nature of Liquid Bodies, that any Vertue received in one part moſt neceſſarily be Diffuſed through the whole, at leaſt in ſome Degree; and therefore there is good Reaſon to believe, that the *Water* is wholly diſtitute of this Petrefying Quality.

But that this Vertue is certainly, if not only, in the Ground or Soil I judge for theſe Reaſons; that there are many *Stones* turned up daily, eſpecially at their breaking up new Ground, which we cannot in any Probability think were brought thither: They are often found at two Miles diſtance from the *Lough*, ſeldom further, in great Numbers, and very deep in the Ground; and a Gentleman (on whoſe Credit I receiv'd the Information) ſaw a Stump of a *Tree* digged out of the *Ground* at a ſmall diſtance from the *Lough*, which by handling of it he found to be Petrefy'd: He aſſured me the Roots and all were Stone, and altogether like thoſe Stones that are ordinarily found, and go by the Name of *Lough-Neagh-Stones*. This Genetleman was of Opinion theſe were *Lapides ſui Generis*, 'till this Obſervation convinced him. And that theſe *Stones* were once Wood is, I think, very certain, for they ſhew the plain *Veſtigia* of Wood; they likewiſe *Burn*; *Cleave*; *Filings* of this *Stone* thrown into the Fire emit a *Fragrant Smell*; and they cut kindly with a Knife, though not ſo eaſily as other Wood.

That not only *Holly*, but alſo other *Wood* has been *Petrefy'd* about this *Lough*, and in the *Soil* adjacent, I have ſufficient Grounds to conjecture on this Account; becauſe ſome Fiſhermen, being Tenants of a Gentleman from whom I had this Relation, told him, they had found buried in the *Mud* of this *Lough* great *Trees*, with all their *Roots* and *Branches Petrefy'd*; and ſome of that bigneſs, that they believed they could ſcarcely be drawn by a Team of Oxen. They broke off ſeveral Branches as big as a Man's Leg, and many bigger, but could not move the great Trunk. By this Bulk of it, I gueſs it to be *Oak*, no Trees in that Country, theſe excepted, growing to that prodigious bigneſs; at leaſt 'tis certain that *Holly* never grows to that Bigneſs.

Two Gentlemen of the North told me, that they themſelves had ſeen the ſame Body *partly Wood* and *partly Stone*: But the only Reaſon for thinking ſo, being the Diverſity of Colours, which might well enough proceed from ſeveral Degrees of Petrefication, we may probably think them deceived;

ceived ; for they made no *Experiments* on that part which they reputed *Wood*.

The *Bark* is never found petrefy'd, as I am informed by a diligent Inquirer, but often ſomething rotten about the Stone anſwerable to the Bark.

Petrefaction, by Mr. Rob. Boyle, n. 6. p. 101.

XXVI. A Gentleman tells me, that he hath met with a place in *England*, where, tho' there be no *petreſying Spring*, (for that I particularly asked) *wood* is turned into *Stone* in the ſandy Earth it ſelf, after a better manner than by any *Water* I have yet ſeen. I find it to be a very odd ſubſtance, wonderfully hard and fix'd. Here is a certain Stone, that is thought to be *petreſy'd Bone*, being in Shape like a *Bone*, with the *Marrow* taken out ; but with a fit *Menſtruum*, I fould that I could eaſily diſſolve it, like other ſoft Stones. And poſſibly it may prove as fit as *Oſteocolla*, for the ſame Medicinal uſes.

By Mr. Phil. Packer, n. 19. p. 329.

XXVII. From the *But* of a growing *Elm* near *Wadley* (a Mile from *Farrington* in *Berks*) one of the ſpreading Claws having been formerly cut off with an Axe, that Part of the *But* from whence the ſame was ſevered, being about 1½ foot above ground, and inward within the trunk of the Tree, hath contracted a petrefy'd Cruſt, about the thickneſs of a Shilling all over the *woody part* within the *Bark* ; the Marks of the Axe alſo remaining very conſpicuous, with this petrefy'd Cruſt upon it.

Petrefying Waters in Scotland, *by* Sir Rob. Sibbald. n. 222. p. 321.

XXVIII. We have ſome Waters in *Scotland* that *petreſy*. Upon the North ſide of the *Firth* of *Forth*, ſome 8 Miles from the City, there is a Cove cloſe upon the Sea, the Roof of which is covered with a *Stalagmites* a Foot deep, like the Fringe of a Bed ; the upper Coat is of a Sea-Colour, the Juice is as white as the *Sal Prunella* ; the Water which droppeth from it, if it touch the Skin, maketh it ſmart. Near to this ſame Cove, is a piece of an hollow Rock, which within, from the Top to the Bottom, is full of ſo many Orders of Columns, reſembling the Pipes of a Church Organ, and ſome of different Figures, I broke a ſmall one and found it ſomewhat hollow in the middle. All the Ground in this place is full of *Lime-Stone*.

The River Greatah running under Ground, by Mr. Hugh Todd. n 163. p. 739.

XXIX. As I travell'd over *Stanemore* in *Yorkſhire*, I obſerv'd the River *Greatah*, (a River about half as big as *Charwell* at *Oxford*) run under ground for about a Mile, ſo that we paſſed over it dry foot. The Paſſage under Ground is but narrow ; ſo that in Winter when the Streams are high, it keeps the Channel above Ground.

A Cataract *in* Gottenburgh *River*, by Mr. Gourdon, n. 266. p. 693.

XXX. At ſome Leagues diſtance from *Gottenburgh* in *Sweden*, that River ruſhes down from a prodigious high *Precipice* into a deep *Pit* with a terrible Noiſe, and ſuch a mighty force, that the Maſts which are floated down this River to *Gottenburg*) uſually turn topſy-turvy in their Fall, and do often fly to pieces when daſhed againſt the ſurface of the *Water* in the Pit. This occurs if the *Maſt* falls ſideways upon the *Water* : but if they fall endways, they dive ſo far under Water, that (according to my Information) they riſe not again for ¼ Hour; others ½ Hour; ſeveral ¾ of an Hour; and ſome a whole Hour and upwards. The *Lake* or *Pit* into which they fall, has been often ſounded with a Line of ſome hundred Fathoms long, but never could they find any Ground.

River Water *recovered after ſtinking*, by .... n. 327. p. 652.

XXXI. Tho' it be commonly reputed peculiar to the *Thames Water* alone, upon ſtinking to be recoverable or potable again; I can affirm upon my own Knowledge, that Water taken a-board at *New-London* in *New-England*, tho' in 8 Days time it ſtunk intollerably, yet when we came to *Virginia*, it recovered ſo perfectly, that I made no Scruple to drink of it in Harbour, even when we had freſh Water newly brought from Shore; nor could I eaſily perceive it had any Relicts of its late Corruption.

Inundations *in Gaſcoyne*, *by* M. Ph. Col. n. 1. p. 9.

XXXII. 1. In the Beginning of *July*, 1678. after ſome gentle rainy days, which had not ſwelled the Waters of the *Garonne* more than uſual, one Night this River ſwelled all at once ſo mightily, that all the Bridges and Mills above *Toulouſe* were carried away by it. In the *Plains* which were below this Town, the Inhabitants who had built in places which by long Experience they had found ſafe enough from any former Inundations, were by this ſurprized; ſome were drowned, together with their Cattle, others had not ſaved themſelves but by climbing of Trees, and getting to the Tops of Houſes; and ſome others who were looking after their Cattle in the Field, warned by the Noiſe which this horrible and furious Torrent of Water (rowling towards them with a Swiftneſs like that of the Sea) in *Britaigne* he means, made at a Diſtance, could not ſcape without being overtaken, though they fled with much Precipitation: This nevertheleſs did not laſt many Hours with this Violence.

At the ſame time exactly, the two Rivers only of *Adour* and *Gave*, which fall from the *Pyranean Hills*, as well as the *Garonne*, and ſome other little Rivers of *Gaſcoygne*, which have their Source in the *Plain*, as the *Gimone*, the *Save*, and the *Rat*, overflowed after the ſame Manner, and cauſed the ſame Devaſtations. But this Accident happen'd not at all to the *Aude*, the *Ariege*, or the *Ariſo*, which come from the Mountains of *Foix*, only that they had more of the ſame than thoſe of the *Conſerunt*, the *Comminge*, and the *Bigorre*.

M. *Martel*, by the Order of M. *Foucault*, hath ſearched after the Cauſe of this *Deluge*, being aſſur'd that it muſt have had one very extraordinary. For all who had ſeen the Circumſtances agreed, that it had rain'd indeed, but that the Rain was neither ſo great, nor laſted ſo long, as to ſwell the Rivers to that Exceſs, or to melt the Snows off the Mountains.

But the *Nature* of theſe Waters, and the manner of their flowing from the Mountains, confirm'd him perfectly in his Sentiments. For, 1. The Inhabitants of the *Lower Pyraneans* obſerv'd, that the *Water* flowed with violence from the Entrails of the *Mountains*, about which there were opened ſeveral Channels, which forming ſo many furious Torrents tore up the Trees, the Earth, and great Rocks, in ſuch narrow places where they found not a Paſſage large enough. The Water alſo which ſpouted from all the ſides of the Mountain in innumerable *Jets*, which laſted all the Time of the greateſt Over-flowing, had the Taſte of the Minerals.

2. In ſome of the Paſſages, the Waters were ſtinking, as when one ſtirs the Mud at the *Bottom* of the mineral water, in ſuch ſort, that the Cattle refuſed to drink of it, which was more particularly taken notice of at *Lomber*, in the overflowing of the *Save* (which is one of the Rivers) where the Horſes were 8 Hours thirſty before they would endure to drink it.

3. The Biſhop of *Lombez* having a deſire to cleanſe his Gardens, which the *Save* paſſing thorow by many Channels by this Overflowing, had fill'd with Sand and Mud; thoſe which entered them felt an Itching, like to that which one feels when one bathes in *Salt-water*, or waſhes ones ſelf with ſome ſtrong *Lixivial*. This *Itching* could not be produc'd by either *Rain* or *Snow-water*, but by ſome *mineral Juice*, either *Vitriolick* or *Aluminous*, which the Waters had diſſolv'd in the Bowels of the *Mountains*, and had carried along with it in paſſing out through thoſe numerous Crannies.

For theſe Reaſons, M. *Martel* believes the true Cauſe of this Overflowing to be be Nothing elſe but *ſubterraneous Waters*. And to explain the Means of this *Irruption*, he ſuppoſes that there is in the Earth a great Number of *Baſons*, *Cavities*, or great *Receptacles* of a vaſt Extent full of Water, from which by divers Iſſues into lower Paſſages there gets and runs out Water enough to furniſh that which runs above the Earth, during the Seaſons that it rains little or nothing.

One cannot well doubt of the Truth of this Suppoſition, if he conſiders, 1. That in *Mines* as well as in *Pits*, the more one digs, the more abundance of *Water* is met with. 2. That there are *Rivers* that the *Earth* ſwallows, as that of *Guadalquivir* in *Spain*, and others that guſh out of it compleat *Rivers*. 3. That there are *Gulfs* in divers parts of the Sea. 4. That there are *Lakes* without *Bottoms*, conſonant to what *P. Kircher* remarks in his *Mundus ſubterraneus*, which diminiſh not at all, and yet receive little or nothing of *Water* from above. Such as are in the ſame *Pyranean Mountains* in the *Lake* of *Bernale* of *Barboiau*, and St. *Pé*. 5. And to conclude, That there are found in *Caves* vaſt *ſubterraneous Lakes*; as amongſt others, that in a Cave near *Grenoble*, of which *Francis* the *Firſt* had the Curioſity to deſire to know the *Extent*, having cauſed a *Boat* to be made for this purpoſe. Hence we muſt conclude, that the *inner parts* of the *Earth* are like a Spunge dipped in *Water*, and ſoaked on every Side; or like our Body filled with differing Veſſels which are the Canals, through which the Blood is communicated to the whole Body.

This being ſo, 'tis not at all difficult to underſtand how the *Earth* thus conſtituted may ſuffer, in proceſs of time, great Changes within its Bowels, as well as on its Superficies, where the *parts* of *Mountains* and vaſtly great *Rocks* ſeparating and tumbling down, cruſh ſometimes whole Towns, as it happen'd in the Year 1618, to the *Town* of *Pleurs* in the *Valtolen*, by the fall of a Rock which hung over that Town. This *Matter* is more eaſily to be done in the Bowels of the *Earth*, becauſe the *Waters* or *ſubterraneous Rivers* do ſoak, and by degrees undermine the parts of the *Earth* which uphold the heavieſt *Mountains*; whence it muſt neceſſarily follow, that theſe ſame *Mountains* muſt ſink down in proportion to the *Maſs* they have loſt. And 'tis certain that ſomewhat like this happen'd in theſe *mountains*, for the people which inhabited thoſe parts, have ſeen the *Earth cleft* in divers places, and have obſerv'd alſo, that in ſome places there have happen'd *Founderings* of the *Earth* for a very conſiderable Extent, one part of the *Mountain* being *ſeparated*, ſunk down, which appeared by the profound *Clefts* many Feet deep, but of little Breadth. So this *Maſs* of the *Mountain* in its *Settling* all at once upon the *Water* of the *Gulfs* or *ſubterraneous Lakes*, which are under the higheſt *Pyrenean Mounts*, in all the *Extent* they take up from *Le Foix*, even to *Bern*, do force the *Water* to guſh out altogether with great violence to the ſame Quantity with the Bulk of that part of the *Mountain* which is *ſettled* in the *ſubterraneous Lakes*, which is the Cauſe of this prodigious Overflowing.

But that which will not ſuffer me to doubt at all but that there was ſome ſuch *ſubterraneous* Tumbling down, is this, that 3 *Months* after this furious *Inundation*, that is to ſay, about the end of *Sept.* there happen'd a 2*d Overflowing* in ſome places near to thoſe where the firſt happen'd, which made alſo great Spoil, particularly that which came from the River of *Ariege*. And twas then remarkable, that a *Fountain* that runs from a Rock upon the *Lot*, near the *Cahors*, conſiderable for the Abundance of its *Water* which turns 3 Mills at its very Source, became all red, which was never ſeen before in the Memory of Man.

Some Effects *of* Vitriolate waters, *by* Mr. J. Beaumont, *Ph. Coll.* n. 2. p. 6.

2. One *Will. Dally* an able Miner, being employ'd at *Week* in *Glocesterſhire*, about 2 Miles from *Kenyſham*, to renew an *Old Work* which was about 6 *Fathom* deep, and was more than half full of *Water*, he drew what he could out with a *Bucket*, and then he went down into the *Mine*, to clear out the remainder. Having ſtood in the *Water* ſome days, his Legs began to itch extreamly, and ſwell'd very much, and at length broke out into Sores. I enquir'd of him how the *Ore* lay in its *Mine*, and he told me the Vein of *Ore* grew in the middle of a Vein of *Sulphur* (as he call'd it) that is, *Marchaſites*, which was about a *Yard* wide; from this I eaſily gathered, that the *Waters* in the Mine having ſtood a longt ime on that large Bed of *Marchaſites*, was ſtrongly impregnated with the *Vitriolate Salts*, which abound in them, and was the Cauſe of the *Itching* and *Swelling* of his Legs.

An Inundation *in* Ireland, *by Dr.* Hook, Ph. Col. n. 2. p. 1.

XXXIII. *June* 26. 1680. An *Inundation* happen'd not far from *Londonderry* in *Ireland*, more monſtrous than that in *Gaſcoygne*. 'Tis ſuſpected that both proceeded from ſome extraordinary Change in the *ſubterraneous Caverns* of thoſe Hills from whence the *Water* guſhed, very few *Mountains* being without them.

Inundations *in* Yorkſhire *By* Mr. R. P. n. 245. p. 382.

XXXIV. 1. The *Inhabitants* of *Kettlewell* and *Starbotton*, in *Craven*, in the *County* of *York*, ſuffer'd a very great Loſs in *June* 1686, by a ſudden *Overflow* of *Water*. The Towns are ſituate under a great Hill on the Eaſt and Weſt; the Country is very *Mountainous* and *Rocky*. The Deſcent of *Rain* was after a Thunder-clap, for about the continuance of an Hour and half with extraordinary violence, and by ſeveral Eye-witneſſes the *Rock* on the Eaſt-ſide open'd viſibly, and Water they beheld thence into the *Air*, the height of an ordinary Church-ſteeple, ſo that the *Current* of *Water* came down the Hill into the reſpective Towns, as in one entire Body, and with a *Breaſt* as if it would have drown'd the whole Towns, ſeveral Houſes were quite demoliſhed, and not a Stone left; others gravell'd to the Chamber-Windows; ſome Inhabitants driven until this Day from their Habitations, the *Current* of the *Water* running thro' their Houſes, mighty Rocks deſcended from the *Mountains* into the *Valley*, and there lie unmoveable; many fair Meadows covered with Sand and Stones, that the Worth of the Soil will not regain the ſame; Houſhold-goods taken away into the great River of *Wharfe*, and ſo loſt, beſides many quick Goods. The Loſs reputed to be many thouſand Pounds; many Families quite ruined, others in part only.

There have been 2 other Floods ſince the firſt, tho' not ſo great and dangerous. The *Becks* or *Currents* of *Water* which run thro' theſe Towns, were ſo gravell'd up by the firſt Flood, that the Paſſage is much altered, and cannot be regain'd, though there have been many Hundreds of Men ſet to do it.

In Mauritius Iſland, By M Roel *of* Diodati; n. 242. p. 268.

2 *Mar.* 22. $169\frac{6}{7}$, at half an Hour after 12 a Clock, being calm, but a little rainy Weather, the River which paſſeth by the plain Ground of *Noordwyck*, did in the ſpace of a quarter of an Hour ſwell to that height, that the *Sugar-Mill*, the *Sugar-work*, and almoſt all the ſaid Ground was thereby ruined, the moſt part of the *Sugar-Canes* being rooted or torn out of the Ground by the Violence of the *Torrent*. We cannot imagine whence ſo ſudden a Swelling of this River has been cauſed, while the *Rain* not being very hard, could not be of that Effect; for in ſuch a Caſe, it ſhould have continued longer; for about 12 a Clock, when the Company's Servants aſſembled for their Dinner, the Water of the *River* was at its ordinary Height, and before they had half dined all the Country was overflown by the Water, *viz.* one Foot higher than 2 Years ago, by Reaſon of the *Hurricane*, when we had ſo violent a Storm as ever was heard of. And at one a Clock all the extraordinary Water was gone, and the River again at its ordinary height. There has been no *Earthquake* that could cauſe it, neither was there any ſuch Thing in other Rivers.

The Origin *of* Fountains *and* Rivers, by M. . . . n. 113. p. 447.

XXXV. In Order to compare the quantity of *Rain* with the quantity of *Water* running away in *Springs* and *Rivers*, it is neceſſary to meaſure theſe two ſorts of *Water*. Thoſe that make Profeſſion of governing and conveying *Spring-Waters*, ſay that a Cubick Inch of *Water* yields in 24 Hours, 144 *Muids*, (the name of a *French Meaſure* holding 280 *French Pints*;) others ſay, it yields but 70 of that Meaſure.

But I have Reaſon to believe, that it yields 83 of this Meaſure, and follow thoſe that ſay, that a Veſſel of 2 Foot deep long and broad holds one *Muid* of *Water*.

And therefore if a *Conſervatory* ſhould hold 3378 *Muids* of *Water*, it would furniſh for a whole Year a ſufficient quantity to make an *Inch* of *Water* run conſtantly. As for the Meaſure of *Rain-water* I have found by *Obſervations*, that from *Oct.* 1668, to *Oct.* 1669, there had fallen ſo much of it as mounted to the height of 18 Inches 7 Lines; and from the ſame Month 1670, to the ſame Month 1671, there happen'd only ſo much as came to the height of 8½ Inches; and from *Jan.* 1673, to *Jan.* 1674, to the height of 27½ Inches. Of which, taking the *Medium*, we have 19 Inches and 2 ^{1} Lines.

This ſuppoſed, let us eſtimate ſome River, as it runs from its very *Source* to a Plaae where ſome *Rivulet* enters into it, and ſee, whether the *Rain-water* that falls about the Courſe thereof, if it were put into a *Conſervatory* would be ſufficient to make it run a whole Year. In order to this, I have conſidered the *Seine*, which from its *Source* to *Ainay le Duc* is about 3 *Leagues* long, and the ſides of its Courſe extend themſelves on the Right-hand and the Left about 2 Leagues on each ſide, where there are other little Rivers that run another way: And, ſince that thoſe *Rivulets* need *Water* to maintain them as well as the *Seine*, I will count but half that ſpace of the ſides, and ſay, that the Place where the *Seine* paſſes hath from its Source to *Ainay le Duc* three Miles long, and two Miles large. Whereupon I ſay further, if a *Conſervatory* were made for this Bigneſs, it would be 6 ſquare *Leagues* in ſurface, which being reduced to *Fathoms*, would make 31245144 Fathoms in Surface. In this Conſervatory, imagine that during a whole Year there has fallen Rain to the Heighth of 19 Inches 2⅓ Lines, as was ſaid before. This Height of 19 Inches and 2⅓ Lines, gives 280899942 *Muids* of *Water*, or thereabout, according to the Meaſure ſuppos'd.

All this *Water* thus collected is that Stock which is to ſerve to make this *River* run for a whole Year, from its Source to the Place before named, and which muſt alſo ſerve to ſupply other Occaſions and Loſſes, ſuch as are the Feeding of *Trees*, *Herbs*, *Vapours* and extraordinary Swellings of the River whilſt it rains, and *Deviations* of the *Water* running another way.

Concerning the Meaſure or Eſtimate of the *Water* of this River, it would be difficult to find it juſt and preciſe, and to determine what quantity it furniſhes. Yet ſo far as I was able to judge, it can have no more than 1000 or 1200 *Inches* of *Water* always running, compenſating the leſſer quantity it hath at its Source with the greater it hath towards *Ainay le Due*: The which I ſo judge by the Compariſon I make of theſe Waters with thoſe of the River of the *Gobelins*, in the Condition wherein it is towards *Verſailles*, where it hath 50 Inches of *Water*, according to the Meaſure taken of it. So that I eſteem it will be enough to allow twenty four or twenty five times as much to our River. For the Channel of it is to be 4 or 5 Fathom large, and for Depth it is but ſhallow; it carries no Boats, and ſerves only to float down ſome loſe Billets.

Theſe Particulars being thus ſuppos'd, I ſay, that 1200 *Inches* of *Water* do furniſh in 24 Hours 99600 *Muids* of *Water* after the rate of 83 *Muids* to an *Inch*, that is, 36453600 for a whole Year. And therefore taking this quantity of 36½ Millions from the 280 Millions, that falls into the *Conſervatory* above deſcribed, there will remain yet above 188 Millions of *Muids*, which amounts to almoſt 5 times as much, and which ſerves to furniſh for the Loſſes, Diminutions, and other Waſtes, above taken notice of. So that there needs but the *6th* part of the Rain and Snow-water that falls in a Year, to run continually thro' the whole Year.

Now if theſe *Rain-waters* are ſufficient to make one River run, they may alſo ſuffice for all the reſt in Proportion; conſidering eſpecially, firſt, what remains for waſte, which is ſuperabundant; and *Secondly*, what little ſpace I allow to both ſides of the River's Courſe, which is but of one League on each ſide. For Rivers are not commonly two Leagues near one another.

It may be objected, that there are Countries where it rains but ſeldom. and ſomewhere it rains not at all, and yet there are conſiderable Rivers. But I anſwer, that the Rivers of thoſe Countries where it rains but ſeldom, do not run continually, being only big in Winter, but in Summer almoſt quite dried up. The Reaſon of both which Effects is, that they being nigh ſome high Mountains whence they come, the Snow that falls in abundance on thoſe Hills, and is melted afterwards, is able, as long as that Water laſts, to make them run abundantly in Winter, leaving them dry when it ceaſes in Summer.

As for the Countries where it rains not at all, there are but few of them in the World. The *Torrid Zone* (where that may be more true than any where elſe) is a *Climate* abundantly moiſtned with *Rains* twice a Year, and it may be more than theſe *Northern Countries*, at leaſt in greater Plenty at certain Seaſons. But if there ſhould be any Countries where no Rain at all ſhould fall, that will not hinder the running of *Rivers* there, becauſe they may have their Sources in other Countries where it rains, as the *Nile* in *Ægypt*, where it rains not.

Mineral Springs, *about* Paderborn *in* Germany, by .... n 7. p. 133.

XXXVI. 1. About 2 Leagues from *Paderborn*, is a treble Spring called *Methorn*, which has 3 *Streams*, two whereof are not above one Foot and an half diſtant from one another, and yet of ſo differing qualities, that whereas one of them is limpid, blewiſh, lukewarm, bubling, and holding *Sal-Armoniack*, *Ochra*, *Iron*, *Vitriol*, *Allum*, *Sulphur*, *Nitre*, *Orpiment* uſed againſt *Epilepſies*, bad *Spleens* and the *Worms*; the other is Ice, cold, turbid, and whitiſh, much ſtronger in *Taſte*, and heavier than the former, holding much *Orpiment*, *Salt*, *Iron*, *Nitre*, and ſome *Sal-Armoniack*, *Allum* and *Vitriol*; of this all Birds obſerved to drink of it do die; which I have alſo privately experimented by taking ſome of it home, and giving it to Hens, after I had given them *Oats*, *Barley*, and *Bread-Crumbs*: For ſoon after they had drunk of it, they became giddy, reeled and tumbled upon their Backs, with Convulſion Fits, and ſo died with a great extention of their Legs. Giving them common *Salt* immediately after they had drunk, they died not ſo ſoon; giving them *Vinegar* they died not at all, but 7 or 8 days after were troubled with the *Pipp*. Thoſe that died being opened, their *Lungs* were found quite ſhrivel'd together. Yet ſome Men that are troubled with *Worms*, taking a little quantity of it, and diluting it in common water, have been obſerv'd by this means to kill the *Worms* in their Bellies, ſo that a great number of *Worms* came from them; whereupon tho' they are ſick, yet they die not. As to the 3*d* Stream that lies lower than the other two, about 20 paces diſtant from them, it is of a greeniſh Colour; very clear, and of a ſoure ſweet Taſt, pleaſing enough. It hath about a middle Weight between the other two, whence we gueſs, that it is mixed of them both, meeting there together; to confirm which, we have mixed equal Quantities of theſe two, with an Addition of a little common *Well-water*, and have found, that they being ſtirred together, and permitted to ſettle, made a Water juſt of the ſame Colour and Taſte of the 3*d* Stream.

At Baſil, *by* ... ib p. 134.

2. At *Baſil*, the Spring running in the *Gerbergaſſe*, (or *Tanners-ſtreet*) from St. *Leonard's Hill*, is of a blewiſh Colour and ſomewhat troubled, holding *Copper*, *Bitumen*, and *Antimony*, about 3 parts of the firſt, one of the 2*d*, and two of the laſt; and have been examin'd by skilful Perſons. Our *Tanners* do water their Skins in it, and being a well-taſted and wholeſome Water, it is both much drunk and uſed to bathe in.

There are two others, called *Randulph's Well*, and *Brun Zam Brunnen*, very obſervable: The former of them having a Camphory and drying Quality, and uſed againſt Hydropical Diſtempers; the latter containing ſome *Sulphur*, *Salt-petre* and *Gold*, and being an excellent Water to drink.

Near Yeoville, *in* Somerſetſhire, by Dr. J. Beal, n. 18. p. 323. n. 20. p. 359.

3. Mr. *Philips* of *Mountague* has in his Paſtures of *Socke*, about 3 Miles from *Yeovill*, a large Pool to which Pigeons reſort, but the Cattle will not drink of it, but not in extream Want of Water. To the *Taſte* it is not only brackiſh, but hath other loathſome Taſts. In a *Venice* Glaſs it looked greeniſh and clear, juſt like the moſt greeniſh Cyder as ſoon as it is perfectly clarified. I boil'd a Pint of it in a Poſnet of Bell-Metal, and ſuddenly it yielded a thick Froth, having ſomewhat of a vitriolate Taſte. Suffering the Water to be boiled all away, it left much of the ſame on the ſides and bottom of the Poſnet.

On Malvern Hill *in* Herefordſhire, *By* Dr. J. Beal, n. 20. p. 358. n. 57. p. 1161

4. There is a *Spring* near the top of *Malvern Hill*, having a long and old fame for *healing of Eyes*; and about a *Furlong* lower is another *healing Spring*. When I was for ſome Years moleſted with *Tetters* on the back of one and ſometimes of both my hands, notwithſtanding all endeavours of my very friendly and ſkilful *Phyſicians*, I had ſpeedy Healing from a neighbouring *Spring* of far leſs Fame. Yet this *Spring* healed very old and ulcerous Sores on the Legs of a poor Fellow, which had been poiſoned by *Irons* in the *Gaol*, after other Chirurgery had been hopeleſs. And by many Trials upon my Hands and the *Tetters*, I was perſwaded, that in long *droughts*, and laſting dry *Froſts*, thoſe *Waters* were more effectually and more ſpeedily healing, than at other times. I held this *Water* in my *Mouth* till it was warm, and perchance ſomewhat intermingled with *Faſting-ſpittle*, and ſo dropping it upon the *Tetter*, I there could ſee it immediately gather a very *thin Skin* upon the raw Fleſh, not unlike that which is ſeen to gather upon *Milk* over a gentle Fire. This *Skin* would have ſmall Holes in it, thro' which a Moiſture did iſſue

in ſmall Drops, which being wiped away, and the Water continued to be dropp'd warm out of the Mouth, the Holes would diminiſh, and at laſt be all quite Healed up.

For the Eye-Waters, I conceived them more ſtrongly *Terſive*, and clearing the Eyes; and they had a Rough Smartneſs, as if they carried Sand or Gravel into the Eye.

5. I think the Waters we call *Chalybeate*, and particularly this at *Farrington*, to be impregnated principally from the *Vitriol*, or *Salt* of *Iron*, which is very Volatile; ſo that little of it can be found by Evaporation of a great quantity, or from the Precipitated Sediment. I put 4 Ounces of ordinary clear Water into a Glaſs, and impregnated it with a known proportion of *Gall*: Then by degrees I let fall into it the *Salt* of *Iron*, until I found it thereby as deeply tinged Red, as the ſame quantity of *Farrington-Waters* would be by the ſame proportion of *Gall*: The quantity of the *Salt* of *Iron* that performed this, was near two *Grains*. This Water, ſo tinged, taſted and ſmelled juſt as the natural Water from the Spring with *Gall* did: If I added a greater proportion of *Salt*, it would make it Nauſeous and *Emetical*.

At Farrington *in* Dorſetſhire; *By Dr.* Highmore, n. 56. p. 1130.

It begins to be in high Eſteem for extraordinary Cures of the *Scorbute*, *Aſthma*, *&c.* It hath [as I have found upon Tryal] a larger proportion of the *Minerals*, than *Aſtrap-Water*; but the force holds not, if Removed from the *Spring-Head*.

n. 51. p. 1039.

6. About a Mile and half out of *Durham*, on the North-Eaſt-ſide near *Butterby*, is lately diſcovered a *Medicinal Spring*, which is this Year much frequented and may be of great benefit to the Country. It was found out by Workmen that dug in that place for Coal. When they were 12 Fathom and an half deep, they diſcovered this Treaſure of *Natural Phyſick*. They then tryed the Rock about 100 Yards off; where they loſt themſelves much about the ſame Depth; and inſtead of *Coal* diſcovered a *Spring* of excellent clear Water, which iſſues out at the Hole which their Inſtruments made.

In the Biſhoprick *of* Durham, *By* Mr. Hugh Todd. n. 163. p. 727

7. At *Lancarim* in *Glamorganſhire* is a *Medicated Spring*, much frequented from ſeveral Counties, time out of Mind, for the *King's Evil*. There is a Rill of about an Ell broad between two Collines, covered with Wood; about 12 Yards from this Spring, the Rill falls from a Rock 8 or 9 Foot high, which makes a grateful Noiſe; the Spring (which is exceeding clear) comes out of a pure White *Marle*; tho' I thought there had been no White *Marle* in *Wales*, for the Earth is Red A *Graduate Doctor* hereabout imputes the Virtue of this Spring to the *Lime-Stone*, and ſays one of the chief Ingredients of the Doctors for the *King's-Evil*, is *Lime Water*.

In Glamorganſhire; *By* Mr. Aubry. n. 233. p. 727.

8. I had a *Mineral Water* ſent me, not long ſince, by Mr. *Duncan* (a Surgeon) from *Eglingham* in *Northumberland*. I found it turned almoſt quite Black with *Galls*, though it had been brought at leaſt 30 Miles by Land-Carriage. After I had ſlowly, in a Glaſs, Evaporated more than one half of this Water, it ſtill retained the ſame *Atramentous* Quality, and ſtruck yet as deep with *Galls* as ever; and at laſt it yielded me a Real and Genuine *Vitriol*. I ſay nothing of the *Ocre* which this Water let fall in very great Plenty, that being a thing common to all *Atramentous Waters*.

At Eglingham *in* Northumberland, *By Dr.* Cay. n. 245. p. 365.

I was ſurprized at this Phænomenon: For I could not bring my ſelf to think it poſſible, that the *Pyrites*, lying conſtantly under *Water*, ſhould ever yield *Vitriol*; and I knew of nothing elſe (at leaſt in *England*) that I could expect it from. But having lately an Opportunity to viſit this *Notable Well*, I found our mighty Rarity, our *Vitriol Water*, to be only on old *Drift* made for the Draining of a Row of old-wrought *Coal Pits* a little above, and I inform'd my ſelf from ſome old Men, that had formerly wrought in theſe Pits, that there was Plenty of the *Pyrites* there, by them call'd, *Braſs Lumps*; and that this *Drift* was ſometimes Dry, and ſometimes ran with a plentiful Stream; which is as fair and full an Account how this Water comes to have *Vitriol* in it, as any one need to deſire.

At St. Amand near Tournay; *By* M. Geoffry, n.247.p.430

9. There has been found a *Mineral Water*, call'd St. *Amand's-Water*, which has been very much in uſe the laſt Summer and Autumn, in all ſorts of Sickneſſes rather for it's Novelty, than for its great and extraordinary Properties. It is call'd St. *Amand*'s *Water*, becauſe its Spring is in the Land depending on the *Abby* of the ſame Name, of the Order of St *Benedict*, in the Dioceſe of *Tournay* in *Flanders*; but the *Fountain* is call'd particularly, *La Fountaine du Bouillon*, for the impetuous Boyling of that Springing Water.

This *Fountain* is ſituated in a Shallow and Marſhy Ground; the Baſon of the Spring is 450 Foot ſquare, there is in the *Bottom* of that Baſon the *Mud* of 20 Foot deep; beyond that they find the Sand, which ſometimes is very moving and at ſome other times is very firm. Very often this *Fountain* caſts up a great Quantity of Sand: And laſt Year in a little Time it caſt up more than 16 Cart Loads of it, by the which all the Baſon was border'd.

There is to be found 3 ſorts of *Earth*; the firſt and Superficial is Black, and Burns as Turf, with the ſame Smell; the ſecond is White; and the 3d has the ſame Colour as the *Slate*. Theſe two laſt ſorts of *Earth* do give, by *Lixivium*, a *Salt* like *Sal Gemma*.

This St. *Amand's-Water* in its Spring is Clear and *Luke Warm*, and appears much *Hotter* at Night and in the Morning, than the reſt of the Day. It has the Smell and Taſte like Standing *Water*. If it is expoſed to the Air it loſes its Smell and Taſte in a ſhort time. By that Facility to loſe its Taſte and Smell, one may judge that it is has a *Sulphur* very *Volatile*; and for that great *Volatility* and *Subtility* it is almoſt impoſſible to make any Experiment upon it.

This *Mineral Water* has the ſame Weight as the *Seine* River Water. It altered not the Colour of the *Syrup* of *Violets*, nor the *Tincture* of *Turne Sol*, *Lime Water*, the *Oyl* of *Tartar*, the *Volatile Spirit* of *Sal Armoniack* and *Hart's Horn* have *Whited* that *Water*, and have made in it a light *Coagulum*.

This Water, mixt with the *Diſſolution* of *Armoniack Salt*, has not given any Smell. It has not alter'd the *Infuſion* of *Galls*. Mingled with the *Solution* of *Vitriol*, has troubled it a little; and has given a Greeniſh Colour, and at length is Precipitated a *Yellow* Powder.

Acid Spirits have not *Fermented* at firſt with that *Water*, but afterward it has made ſome little Bubbles, which remained to the ſide of the Glaſſes wherein were contained the Liquors.

I have Diſtilled 5 Pints of that *Water*; the Diſtill'd *Water* has not had any Taſte nor Smell, and it has not changed the Tincture of *Turne Sol*, neither the *Lime-Water*. There remained from that 5 Pints (or 160 Ounces) 70 *Gr.* of *Reſidue*; the which, by *Lixivium* has given to me 55 *Gr.* of Grey Earth, and 15 *Grains* of *White Salt*, almoſt like *Sal Gemma*.

The *Reſidue* of the Evaporated *Water* put upon the Burning Coals, has not caſt any Smoak, neither has made any *Detonation*; the *Spirit* of *Nitre* poured upon it, has very much *Fermented*; the *Spirit* of *Wine* has not extracted any *Tincture* from that *Reſidue*.

One may conclude by all theſe Experiments, that this *Water* has not any *Acidity*, it participates not of *Vitriol* nor of *Alum*; and there is in it but a little Quantity of the *White Earth*, and leſs alſo of *Salt* very like *Sea Salt*.

They are the Parts of *Earth* and *Salt*, which ſhew themſelves in the Mixture of the *Lime Water*, &c. of *Fix'd* or *Volatile Alcalis*.

They are the ſame Parts which begin that light *Fermentation* in the Mixture of *Acid Spirits*; but that *Fermentation* is imperfect becauſe of the little Quantity of the *Earth*, which is drown'd in ſo great a Quantity of Liquor; in Effect when the *Water* is *Evaporated*, the *Acid Spirits* do *Ferment* very much with the *Reſidue*.

It appears by the Smell of that *Water*, that it contains a *Sulphur* very *Subtile*, which diſſipates it ſelf very eaſily, and which is not ſenſible in the Experiments. 'Tis neverthelcſs to be attributed to that *Sulphur*, the principal Effects which they do attribute to that *Mineral Water*, as of helping in the *Palſy*, &c. In other ſorts of Diſtempers where the *Nervous Gender* is attack'd; in *Short-Breath*, and in all Affections of the *Lungs*; and of Remedying many other Infirmities which are cauſed by the *Sharp Ferments*, the which are ſweetned by that *Water*. For the other Properties of it, as of *Purging*, of taking away Obſtructions, of Tempering the *Hot Intrals*, &c. it may have the ſame Effects with common Water being drunk abundantly.

One may Drink many Glaſſes of this *Water*, beginning by 4, 6 or 8 every Morning, and augmenting till 12, 18, 20 or more, according as the Stomack is able to ſupport it. This *Water* Paſſes readily by *Urine*, and many Perſons are Purged by it. Sometimes one may mix with it ſome *Diuretick Salt*, to make it Paſs more freely, and for rendring it more *De-obſtructive*. At other times one may put ſome *Manna* or other things for making it more *Purgative*. One may Waſh alſo in the Mud of that *Fountain*, according to Neceſſity.

A Spring that is never Frozen; *By Dr.* J. Beale. n. 56. p. 1139.

XXXVII. I have obſerved a *Spring*, that in all the Extream Froſts, that have been theſe 10 Years, hath yielded a ſmall Stream, which running over a large Tract of Paſture, keeps all the Banks and Borders *Green*, and free from *Freezing*, Diſſolving the *Snow*, and *Smoaking* all the way where it runs.

XXXVIII.

The Baths in Somerſet ſhire, By Mr. Joſ. Glanvill. N. 49. p. 977.

XXXVIII. 1. The Country round *Bath* is very Hilly and Uneven; but the Hills lie in order; they are generally Rocky and Steep from South-Weſt and by Weſt, to North-Eaſt and by North: The whole Tract of the Country, within 5 and 7 Miles, abounds with Coal-Mines, more or leſs. But there are no other conſiderable Mines that I can hear of, nearer than *Mendip*, which is 10 Miles hence, excepting ſome of Lead at *Berry* in *Gloceſterſhire*, which lies upon the *North* of this Place, about 4 or 5 Miles diſtant.

2. The Hills for the moſt part afford a Free-Stone; and on the North-Weſt of *Lansdown* (which hath that Situation to the Town, and is juſt above it) the Stones digged there, are a ſort of Hard Stone, commonly call'd a *Lyas* blue and white, Poliſhable.

3. The *Town* and *Baths* are of very great Antiquity. Beſides what I find in very ancient Chronicles to that purpoſe, one of our great Antiquaries (Mr. *P.*) aſſerts, that theſe *Baths* were 800 Years *before Chriſt*: Which if ſo would give occaſion to enquire, how conſiſtent with it that Hypotheſis, concerning the Cauſe of the *Heat* of theſe *Waters* may be, which makes it to be the *Fermentation* of Minerals *in fieri*; and whether it be likely, that the Minerals through which theſe *Waters* paſs, ſhould be in that ſtate of Imperfection ſo many Hundred Years. But this other Opinion ſeems to me very Probable which ſuppoſeth the Cauſe of the Heat to be, that two Streams having Run through and Imbibed certain ſorts of different Minerals, Meet at laſt and Mingle their Liquors, from which *Commixture* ariſes a great *Fermentation* that Cauſes *Heat*; like as we ſee it is in *Vitriol* and *Tartar*, which when Mingled beget an *Intenſe Heat* and *Ebullition*.

4. It is affirmed here, that the *Town* for the moſt part it built upon a *Quagmire*, though the Places all about it are very firm Ground. Some Workmen, that have been employed in digging, have found a *Mire* 10 Foot deep: Without the *North* gate, the higheſt place of the Town, at *Seaven*. The *Earth* between is a kind of Rubbiſh; ſometimes they find *pitching* a Man's length under Ground, and paſſages for the Water to paſs 7 or 8 *Feet* down they have met with *Oyſter-ſhells*.

5. The *Town* and *Country* circumjacent, generally abound with *Cold Springs*: And in ſome Places the *Hot* and *Cold* ariſe very near each other; in one Place, within *two* Yards, and in others, within 8 or 9 of the Main *Baths*.

6. The *Guides* of the *Croſs-Bath* inform me, that when there is a great Weſt Wind abroad, ſtanding by the *Springs* they feel a Cold Air ariſing from beneath: If the Wind be at Eaſt and the Morning cloſe with a little miſling Rain, the *Croſs Bath* is ſo *Hot* as ſcarce to be endured, when the *King's* and *Hot Baths*, are *Colder* than uſual. In other Winds let the *Weather* be how it will, this *Bath* is *Temperate*. The *Springs* that *Bubble* moſt are *Coldeſt*. The *Croſs-Bath* fills in 16 Hours, both in *Winter* and *Summer*, without any difference from *Heat* or *Cold*, *Flouds* or *Drought*; That of the *Kings* in 12 or 14 Hours.

7. A Man may better (ordinarily endure 4 Hours Bathing in the *Croſs Bath*, than 1½ in the others. In the *Queen's-Bath* (which hath no Springs of its own; but comes all out of the *King*'s) they have found under a flat Stone, which upon occaſion was taken up, a Tunnel, and a Yielding Mud in and under it, into which they thruſt a Pike, but could feel no bottom. In the *King's Bath* there is a Spring ſo *Hot*, that it is ſcarce Sufferable, ſo that they are fain to turn much of it away, for fear of inflaming the *Bath*. The *Hotteſt Spring* will not harden an Egg.

8. The *Bath Water* does not paſs through the Body like other *Mineral Waters*; but if you put in *Salt* it Purgth preſently. Upon *Settlement* it affords a Black Mud, uſeful in *Aches*, applyed by way of *Cataplaſm*; to ſome more ſucceſsful than the very *Waters*. The like it *Depoſits* upon *Diſtillation*, and no other. Nor hath any more been diſcovered upon all the *Chymical* Examinations, that have come to our knowledge. One Dr. *Aſtendoff* found, that the Colour of the *Salt*, drawn from the *King's* and *Hot Bath*, was Yellow; that which was extracted from the *Croſs-Bath*, *White*. This Dr. Concluded, that the *Croſs Bath* had more of *Alum* and *Niter*, than the *Hotter Baths*, which abound more with *Sulphur*. And yet that *Bath* looſens *Shrunk Sinews*, by which it ſhould ſeem it abounds not much with *Alum*. It is Harſher to the Taſte than the other *Baths*, and Soaks the Hands more.

9. A Man cannot Drink half the quantity of Strong Drinks in the *Bath*, that he can out of it; but if he hath Drunk before to exceſs, it allays much, and is a great refreſhment to the Body. The *Bath* provoketh *Urine*.

10. They are very uſueful in *Diſeaſes* of the *Head*, as *Palſies*, *Epilepſies*, and *Convulſions*; In *Cuticular Diſeaſes*, *Leproſies*, *Itches* and *Scabs*; in all *Obſtructions* of the *Bowels*, as *Spleen*, *Liver*, and *Meſentery*, and the *Schirroſity* and Hardneſs of thoſe Parts; in moſt *Diſeaſes* of *Women*; in the *Scurvy* and *Stone*: As to which laſt while I am Writing, an Alderman of the City aſſures me, that his Wife, who had been exceedingly troubled with the *Stone*, went into the *Croſs-Bath* for it, and *Voided* there ſeveral *Stones* as big as thoſe of *Olives*, and was never troubled with that Diſtemper after. The *Bath* is alſo good in *Cold Gouts*, as they call them.

The ſame Alderman tells me, that it gives him preſent Eaſe, when he is troubled with the Fits of it. He uſes to go in, as ſoon as the fit takes him; which then goes off preſently, and returns not in a conſiderable time after: He puts his Feet upon the *Hotteſt Springs* in the *King's Bath*.

But it hath a contrary Effect in *Hot Gouts*; and ſome who are troubled with that Diſtemper tell me, that the *Bath* puts them into a Fit if they go into it without Preparation; or if they have the Fit before, it inflames it more, and ſends it about the Body, and diſables the Joynt ſo, that there is no Treading on it for the preſent. Further, the *Bath* is effectual in the *Diſeaſes* of *Children*, particularly the *Rickets*, removing the Humours that proceed from it without fail. 'Tis alſo good for *Women* that are apt to *Miſcarry*, if uſ'd moderately. The *Bath-guides* go in, when then are ready to Lie down; and other Women of the Town uſe it ordinarily throughout their Time, and are never obſerved to Miſcarry. It facilitates Deliverance. Beſides is very effectual for the Strengthning of *Broken Bones*, and good in all *Cold* and *Moſt Diſtempers* and *Weakneſs* of *Nerves*, *Stupefactions*, *Relaxations*, and Violent *Pains*: In all which it gives Eaſe, except the *Lues Venerea*, for in that (except the Malignity be overcome by the Methods of Phyſick) it Exaſperates the Pain more. 'Tis an excellent Remedy to remove the remaining *Weakneſs* in *Gouts*, as hath been remarkably exemplified in Old Men, even to the Age of 83 Years.

11. There is no inſtance of Cures performed by it in former Times, but we have the experience of it in ours; yea and in ſome others, as in *Dropſies*, *Cachexies Spleen*, *&c.* In which Caſes they were Shy heretofore of uſing the *Bath*, for fear of confirming thoſe *Obſtructions*, whereas 'tis now found, that their Cure is Facilitated by it.

12. The *Bath-guides* live to a very great *Age*, ſometime to near 100 Years ordinarily, if they are Temperate to 70. There are two at this time above 80, a Man and his Wife.

13. In the *Croſs-Bath* the *Guides* have obſerved a certain Black Fly with Sealed Wings, in the form of a *Lody-Cow*, but ſomewhat bigger. They ſay, it ſhoots quick in the *Water*, and ſometimes Bites. It lives under the *Water*, and is never found but in very *Hot Weather*. They ſuppoſe it comes up with the *Springs*. It is not to be ſeen elſewhere.

14. The *Croſs-Bath* Eats out Silver exceedingly; and I am told that a Shilling in a Weeks time hath been ſo Eaten by it, that it might be wound about one's Finger. The *Baths* agree (as the Vulgar ſpeak) with *Braſs*, but not with *Iron*: For they will Eat out a Ring of this Metal in 7 Years, when *Braſs* Rings ſeem to Receive no prejudice at all from it.

15. When Women have waſh'd their Hair with the mixture of Beaten Eggs and Oatmeal, this will Poiſon the *Bath* ſo, as to beget a moſt noiſome Smell caſting a *Sea-Green* on the Water, which otherwiſe is very Pure and Limpid. This will Taint the very Walls, and there is no Cleanſing of it, but by Drawing the *Bath*.

16. In Summer the *Baths* purge up a Green Scum on the *Top*, but in Winter never; but then leave a Yellow on the Walls.

17. The Walls that keep in the *Hot Springs* are very deep ſet, and Large; 10 Foot thick, and 14 deep from the Level of the Street. The *Cement* of the Wall is Yellow Clay, Lime and beaten Bricks. In the Year 1659. the *Hot Bath* (a *Bath* particularly ſo call'd, of equal *Heat* with the *King's Bath*) was much Impaired by the breaking out of a *Spring*, which the Workmen at laſt found again, and reſtored. In Digging they came to a firm Foundation of Factitious Matter, which had Holes in it like a Pumice Stone, through which the Water played; ſo that 'tis like the Springs are brought together by *Art*: When probably was the *Necromancy*, the People of ancient times believed and reported to have contrived and made theſe *Baths*; as in a very ancient *Manuſcript* Chronicle I find theſe Words: *When* Lud Hidibraſs *was Dead*, Bladud *his Son*, *a great* Nygromancer (*ſo 'tis there writ*) *was made King he*, *made the Wonder of the* Hot-Bath *by his* Nygromancy; *and he Reign'd*

21 *Years, and after he died and lies at the* New Troy. And in another old Chronicle 'tis ſaid, *That King* Bladud *ſent for the* Necromancers *to* Athens *to Effect this great buſineſs*; who 'tis like were no other than cunning Artificers, well Skill'd in *Archite∂ure* and *Mechanicks*.

18, It hath been obſerv'd, that *Leaves*, like thoſe of *Olives*, come ſometimes out of the Pump of the *Hot Bath*.

2. Theſe *Waters* have been long Famous for the Cure of *Palſies* and *Barrenneſs*: An Inſtance of both in one Perſon, I ſhall now give you. A Gentlewoman of about 30 or 32 Years of Age, having been Married about 10 or 12 Years, and never with Child, was ſuddenly ſeiz'd with a *Palſy* on the Left ſide, for which (after 8 or 10 Months Tryal of other Means to little purpoſe) ſhe was brought to the *Bath*, where (after uſual Preparations, and ſome internal Means) ſhe continued that Seaſon, about 6 Weeks; the Winter coming on ſhe was forced to deſiſt; but (by the Advantage ſhe received, was Encouraged to come very early the next Year, and did continue with us the whole Summer, and recovered, in great Meaſure, the uſe of her Arm and Hand, Leg, and Tongue; and not only ſo but, in a few Weeks after, ſhe returned to her Husband) Conceived with Child, and had (at about a Years and halfs diſtance between them) 5 Children, following. She ſhew'd me 4 of them Luſty and Strong and will grown for their Age, the 5th died. She her ſelf had no return of a *Palſy* but is *Infirm*, I think *Conſumptive*; ſhe is now about 51 Years Old. *By Dr.* Pierce n. 169. p. 944.

XXXIX. At *Baden* a little City in *Auſtria*, 4 German Miles Southward from *Vienna*, ſeated on a Plain but nigh unto a Ridge of Hills, which are the Excurſions of Mount *Cetius*, are convenient *Baths*; two within the Town, five without the Wall, and two beyond a Rivulet called *Swechet*. Baths *in* Auſtria *and* Hungary; *By* Ed. *Dr.* Brown, n. 59. p. 1044.

The *Duke's Bath* is the largeſt, about 20 feet ſquare, in the middle of an Houſe of the ſame Figure, built over it. The Vapour paſſes through a Tunnel of Wood, at the Top: And the Water is conveyed into the bottom of the *Bath*, at one Corner, through wooden Pipes and Trees, under the Town-Wall, from the Spring-head, which Riſeth at a little diſtance Weſtward. The Springs of the reſt of the *Bath* Riſe under them, and are let in through Holes of the Plancher, for all the *Baths* are Wainſcotted, the Seats, Sides and Bottoms being made of Fir. The Water for the moſt part is Clear and Tranſparent, yet ſomewhat Blewiſh, and maketh the Skin appear Pale in it, as doth the Smoak of *Brimſtone*. It coloureth Metals (except Gold, whoſe Colour it alſo Heightens) turning them Black in a few Minutes. The Coyn of this Country, mixt of Copper and Silver, (having $\frac{7}{15}$ of Silver, and $\frac{8}{15}$ of Copper) is in a Minutes time turned from a White into a dark Yellow, and ſoon after becomes Black. To the Moſs and Plants which it Waſheth, it gives a fine Green Colour, and leaves often a Scum upon them of a Purple mixt with White. As it runs from the Spring-Head, it ſomewhat reſembles the *Sulphur River* in the way from *Tivoli* to *Rome*, but is not ſo ſtrong or ſtinking, nor doth it Incruſtate its Banks.

I paſs'd to the Spring-Head (which Riſeth under a Rocky *Hill*) about the length of 40 Yards, through an Arched paſſage cut in the Rock, which is alſo a *natural-Stove*, (as that of *Triʋola* and *Baja*) made by the *Hot-Bath-Water* running under it. Moſt part of this Cave is incruſtated with a white ſubſtance, by them called *Salt-Peter*. At the Mouth of the Cave it becomes Harder and Stony.

I cauſed ſome of the Pipes, through which the *Bath-Water* runs, to be opened, and from the upper Part of the Pipe, I took ſome quantity of *Fine Sulphur* in *Powder*, ſomewhat like *Flowers* of *Brimſtone*; this being as it were Sublimed from the Water, and not depoſed, being found in the upper part of the Pipe. *Oleum Sulph per Campanam* dropped into this Water, is received into it quietly. *Oleum Tart. per Deliquium*, cauſed an *Ebullition*, as in the making of *Tartarum Vitriolatum*.

The Second *Bath* within the Wall is that of our *Lady*, about 12 foot broad, and 24 long. One end of it is under a Church of the ſame Name. This is fuller of Sulphur than the reſt, and more Blue, and leaveth a Yellow Flower upon the boards as the others do a white.

The 3*d* is the *New Bath*, out of the Town nigh the Gate.

The 4*th* the *Jew's Bath*, which hath a partition in the middle to ſeparate the Men from the Women.

The 5*th*, St. *John's Bath*, of a Triangular Form.

The 6*th*, the *Beggars Bath*, always Shallow, ſo as they lie down in it.

The 7*th*, the *Bath* of the *Holy Croſs*, about 2 Fathoms Square, chiefly for the *Clergy*.

The 8*th*, St. *Peter's Bath*. *Greener* than the reſt.

The 9*th*, the *Sower Bath*, ſet about with Stone-balaſtres, and covered with a Cupola and Lanthorn. The Water is very Clear: In the Steam of this *Bath* I have often coloured Money Black without touching the Water; and ſtaying only in the room where the *Bath* is, the Buttons of my Cloaths, and what elſe of Silver the Vapour could come at, were coloured Yellow or Guilded: And yet the Water it ſelf, once Cold, changeth not the Colour of Metals, though Boiled in it.

The *Hotteſt* of theſe *Baths* have not the *Heat* of the *Queen's Bath* at *Bath* in *England*. They uſe no *Guides*, as with us, but direct themſelves with a ſhort turn'd Staff.

Manners-dorff, ſeated under an Hill on the Eaſt ſide of the River *Leyta* hath only one *Bath*. It Riſeth under a Church, built over the Spring-Head.

The Water of it is *Luke-warm*, and therefore they Boyl it in great Coppers, when they deſire it *Hotter*, and *Bath* in Tubs fill'd with this boyling Water. From the Subſtance, which ſticks to the Coppers in boyling, it is collected, that it is Impregnated with Sulphur, *Salt-peter* and *Chalk*. This Water coloureth the Stones in it of a fair Green like a *Turkois*; and the

Steam of it, which ſticks to the Moſs under the Church, turns into Drops of Gold or Amber.

Dotis, 2 *Hungarian* Miles from *Comora* in *Hungary*, hath alſo ſulphurous Baths, ſaid to be warm in Winter. In *March* and *October*, I found their Warmth very remiſs, ſcarce perceivable. In Colour they are blueiſh, and to Taſte, acid. The Queen's Bath, and the great Bath riſe in a Marſh, Northward of the Caſtle.

There is another Bath in the Governour's Garden within the *Town*. They are uſed as thoſe of *Manners-dorff*.

At *Banka*, two *Hungarian* Miles from *Freiſtat*, in a Meadow, I took Notice of 15 Baths: And there have been more, but the River *Waag* eateth away the Banks, and ſwallows up the Baths, and into 3 of theſe 15 it hath alſo broke in. The Water of theſe is like to that of *Baden* in *Auſtria*; it leaves a white Sediment upon the Moſs and Places it waſheth, and tinctureth Metals black. I ſtuck ſome Money into the Ground, over which the Water paſſeth that part which was in the Ground retained its own Colour, and the other part in the *Bath-Water* acquired a Coal Black. Theſe Baths are open, and very hot.

The Baths of *Boinitz* nigh the River *Nitra* in *Hungary*, are of a moderate gentle Heat, much beautified by Count *Palſi* Palatine of *Hungary*: And all of them covered under one large Roof; the firſt is the Nobleman's Bath, built of Stone, deſcended into on all ſides by ſtone Stairs; Four more there are of *Wood*, but very handſomely and well built.

At *Stub'n* 3 *Hungarian* Miles from *Newſol*, and 2 from *Chremnitz*, near to a Rivulet, are divers Baths of great Eſteem. The Water whereof is clear, and ſmells of *Sulphur*, the Sediment green. It colours the Wood over it green and black, but does not change the Colour of Metals ſo ſoon as moſt others. I left Money in it a whole Night, which was yet but faintly coloured. The Springs ariſe underneath, and paſs thro' the Holes in the plancher of the Baths; the Heat thereof is anſwerable to the King's Bath in *England*. Theſe Baths are 7.

The firſt is the Noblemen's Bath; the 2*d* the Gentlemen's Bath; the 3*d* the Countryman's; the 4*th*, the Countrywoman's; the 5*th*, the Beggar's Bath; the 6*th*, for ſuch as are infected with the *Lues Venerea*; the 7*th*, the Bath of the Gypſies; of whom there are many in thoſe parts. Theſe *Baths* are in a Plain, encompaſſed on all ſides with Hills, the nigheſt unto them are towards the Eaſt, and it is the ſame Ridge of Hills, which on the other ſide are ſo rich in Metals.

Glaſs-Hitten, an *Hungarian* Mile, or about 7 *Engliſh* Miles from *Schemnitz*, hath 5 Baths; two of which are large. It depoſes a red Sediment, and incruſtates the Wood and Seats of the Bath under Water with a ſtony Subſtance; and it guildeth Silver. But the moſt remarkable of theſe Baths, is that which is called the *Sweating Bath*, whoſe hot Springs drain thro' an Hill, and fall into a Bath built to receive them; at one End of which by aſcending I went into a Cave, which is made a noble Stove by the Heat of theſe *Thermæ*, and ſo ordered with Seats, that every one who ſits in it, either by chuſing a higher or lower Seat, may regulate his Sweating, or enjoy what degree of Heat he deſireth. This Cave as alſo the ſides of the Bath, are covered by the continual dropping of thoſe hot Springs, with a red, white, and green Subſtance; the red and green make the beſt Shew, but the white is uſed againſt the Stone, and cureth Ulcers, and ſore backs of Horſes.

Eiſen-bach, about 4 *Engliſh* Miles from *Glaſs-Hitten*, and 5 or 6 from *Schemnitz*, hath alſo *Hot Baths*. I have ſeen great Trees placed at the top or Superficies of the Water in theſe Baths, which have ſuffer'd Petrefaction. Here are two convenient Baths, much frequented; and a 3*d*, which is made by the Water let out of the former, called the *Snake's Bath*, from the Number of *Snakes* coming into and delighting in it, when 'tis fill'd with theſe warm Waters.

The natural Baths of *Buda* are eſteemed the nobleſt of *Europe*, not only in Reſpect of the large and hot Springs, but the Magnificence of their Buildings.

For the *Turks* bathe very much, and tho' little curious in moſt of their private Houſes, yet are they very ſumptuous in their publick Buildings, as their *Chans* or *Caravanſara*'s, *Moſches*, *Bridges*, and *Baths*, declare.

There are 8 Baths, whereof I had opportunity to take Notice, during my Stay at *Buda*; 3 towards the Eaſt, and South Eaſt part of the City, in the way leading towards *Conſtantinople*, and 5 toward the Weſt-end of the Town in the way towards *Old Offen*, and *Strigonium*.

The firſt is a large open Bath at the Foot of an high rocky Hill, formerly called *Purgatorium*, whereof the People have ſome odd and ſcrupulous Apprehenſions.

The 2*d* is covered with a *Cupola*, and ſtands nigh the ſame Hill, but more into the Town, and near a place where they uſe *Tanning*.

The 3d is call'd the *Bath* of the *Green Pillars*, tho' at preſent they be of a red Colour; and it ſtands over againſt the *Caravanſara*. The Water is hot, but tolerable without Addition of cold Water. It is impregnated with a petrefying Juice which diſcovers it ſelf on the Sides of the *Bath* upon the Spout and other places, and maketh a grey Stone; And the Exhalation from the *Bath*, reverberated by the *Cupola*, by the Irons extended from one Column to another, and by the Capitals of the Pillars, formeth long ſtones like *Iceicles*, which hang to all the ſaid places; ſuch as may be obſerved in many ſubterraneous Grotto's, and particularly in *England*, in *Okey-hole* in *Somerſetſhire*, and *Pooles-Hole* in *Derbyſhire*.

The Water is let out at Night, when the Women have done *Bathing*, who often ſtay late. The *Bath* is round, ſet about with large Pillars, ſupporting a *Cupola*, which hath Openings to let out the Steam thereof, and yet the whole Room continues to be a hot Stove.

The *Baths* of the Weſt-end of the *Town*, are,

1. *Tactalli*, or the *Bath* of the *Table*; a ſmall *Bath* covered: The Water white and of a ſulphurous *Smell*.

They drink of this as well as bath in it. What they drink, they receive from a Spout bringing the Water into this place. I delivered a 5 *Sols* piece to a *Turk* bathing in it, to guild for me, which he did in about a Minute, by rubbing it between his Fingers, while the hot Water ſell from the Spout upon it.

2. *Barut Degrimene*, or the *Bath* of the *Powder-Mill*. It riſes in an open Pond near the high way, and mixeth with the freſh Springs, ſo that the Pond is of a whitiſh Colour in one part, and clear in the other, as alſo cold and hot in ſeveral parts. This conveyed croſs the High-way into a *Powder-Mill*, becomes uſeful in making of *Gun-powder*. They conceive here that this Bath communicates with the ſulphurous Springs at *Dotis*, many Miles diſtant.

3. *Cuzzoculige*, the little Bath, or the *Bath* of the *Saint*; for which name the *Turks* give a ſuperſtitious reaſon. 'Tis kept by *Turkiſh Monks*; the Bath where the Springs ariſe, is ſo hot as ſcarce to be endured; but being let out into another Bathing-place at ſome diſtance, it becomes tolerable and fit for uſe. This Water hath neither *Colour*, *Smell*, nor *Taſte*, different from common Water, and depoſeth a Sediment; only the ſides of the Bath are green, and have a fungous ſubſtance all over.

4. *Kaplib*, a very noble Bath, but part of the Buildings were conſumed this Year, (1669) by o great Fire which happen'd in *Buda*, but is by this time repaired by the *Turks*. The Water is very hot, not without petrefying Juice in it. The Buildings about it are eight Square, with a noble Bath in the middle, with a *Circle*, or *Trench* of Water about it for the better Ornament. On every Side it has a *Nichio* wherein is a Fountain. In the middle of the *Anti-chamber*, (where they leave their Cloaths) there is alſo a fair Stone Baſon, and a Fountain.

5. The *Bath* of *Velibey*, which hath a ſtrong ſulphurous Smell, and a Petrefying juice in it; and is ſo hot, that to make it tolerable, it requires the addition of cold Water; this is the nobleſt Bath of any. The Anti-chamber very large, the Bath-room capacious, and high arched and adorned with 5 *Cupola's*: One a very fair one, over the great round Bath in the middle; and one leſſer, over each of the 4 Corners; where are either Baths or Bath-ſtoves for more private uſe: In theſe the *Turks* take off the *Hair* of their Bodies by a *Pſilothrum* mixt with *Soap*; it being not their Cuſtom to have any *Hair* except on their *Beards*, and a Lock on the Crown of their *Heads*. Twelve Pillars ſupport the great *Cupola*, between 8 whereof are Fountains of the hot Water, and between the other are places to ſit down, where the *Barbers* and *Bathmen* attend. And each of theſe Places have two Ciſterns of Free-ſtone, into which are let in hot Bath-water, and alſo cold Water, to be mixed and tempered as every one pleaſeth.

Men bath in the Morning, and *Women* in the *Afternoon*. When any Man intends to bath, having entred the firſt room, he finds there divers *Servants* attending, and furniſhing him with *a Cloth* and *Apron*. Then he puts off his apparel, and having put on the *Apron*, he entereth the 2d room, wherein the great Bath is, and ſits on the ſide of the Bath, or between the *Pillars* nigh a

Fountain ; where the *Barber* ſtrongly rubs him with his Hand opened, ſtretching out his Arms, and lifting them up ; after which the Party batheth. Then if he be a Subject of the *Grand Seignior's*, or it be the Cuſtom of his Country, he hath his Head ſhav'd, and if a young Man, his Beard, except the upper Lip. Next the Barber rubs his Breaſt, Back, Arms and Legs with an *Hair-cloth*, while he either ſitteth or lieth with his Face downward ; then waſhes his Head with Sope, and after throws cold Water upon him all over his Body, and ſo the Party walks about in the Steam of the *Bath* for a time.

Theſe *Baths* are made uſe of two Ways, either by entring into the water, or ſitting about the *Bath* in the Steam. For the Vapour of the *Bath* makes the whole Room a Stove, and moſt ſweat as long as they ſtay in it ; and ſome enter not the Water at all, but have it poured upon them, or elſe only continue in the Steam of the *Bath*, which ſufficiently provoketh ſweat.

At Aponum *near* Padua, By Mr. Coddington, n. 83. p. 4067.

XL. Five Miles from *Padua* are the Waters call'd *Aponenſia*, from a *Town* call'd *Aponum*. They are actually very *hot* and *ſtinking*, and yield a great deal of very fine Salt, of which the *Natives* ſerve themſelves in their ordinary occaſions. The Salt is gather'd after this manner : the *Natives*, after Sunſet, ſtir pieces of Wood in the Water, and preſently the Salt ſticks to them, and comes off in ſmall Flakes, exceeding white, and very Salt ; this never loſeth its Savour. The People there, with the ſame Water uſed to waſh their Walls, to render them whiter than ordinary ; which it doth even whiter than *Lime*. Such *walls* conſerve their *ſaltneſs* ſome few *days* only, and then become inſipid, even tho' they ſweat forth a white Excreſcence in thin and light Flakes like *Nitre*, many Years after. But that Salt that is collected from the Stones, Gravel and Earth, by which the Rivulets deſcending from theſe Baths, do run, is without any Taſte of Salt, though there be no difference in the Form or Colour, from that which is gathered with the wooden Inſtruments.

Hot Springs and other Mineral Waters *in* Jamaica, by Sir William Beeſton, n. 220. p. 226.

XLI. In *Jamaica* there is a very *hot Spring* of *Mineral Water*, but the diſtance and trouble of getting to it has kept people from trying it till this laſt *Month* (*viz. Mar.* 169$\frac{5}{6}$) when 2 Perſons, the one very much macerated with the *belly-ach*, and another with the *Pox*, as is ſuppoſed, went to it, carry'd *Cloaths*, built a *Hut* to keep them from the Rain and Sun, and both preſently by *drinking* and *bathing*, found ſuch eaſe, that in about 10 Days they returned perfectly cur'd. It comes out of a Rock in a freſh *Current*, near to a fine Rivulet of good cool Water, but is ſo *hot*, they all affirm it ſoon boils *Eggs*, ſome ſay *Craw-fiſh*, *Chickens*, and even a *Turkey* ; but perhaps this laſt wants good *Confirmation*. However it's certain, that near where it comes forth, there is no enduring any part of the Body but it takes off the Skin ; it cures *Ulcers* and *contracted Nerves* and *Sinews*, in a few days, to a Miracle. Coll. *Beckford*, who was given over by the *Phyſicians*, with Pains in his Bowels very acute, that had worn him out, and another for the *Venereal Diſeaſe*, and one for the *Belly-ach*, went up ſince. Coll. *Beckford* is finely recovered and the other almoſt cured of his Ulcers ; ſo that the Water is beyond doubt, and many are reſorting to it.

It has been try'd with *Galls* in my *Sight*, and it makes the Water in 24 Hours look only like *Canary*, or *Old Hock*. But we have a fine large River runs by the ſides of this Town, which ſerves all the People for drinking and other uſes, and was by the *Spaniards* call'd *Rio Cobre*, or the *Copper River*, this now our Curioſity has led us to try with *Galls*, and in one Night the Water turns to a deep Green, more inclining to black, deeper colour'd than any *Emerauld* I ever ſaw, which makes me doubt the *Copper Mines* in it are not enough digeſted, and that it's unwholſome, but were the Copper more refined and excellent, it would be a ſalubrious Water. I have alſo tryed ſeveral Water-ſprings, and Rivers hereabouts, and find them all ting'd with ſome Metal or other.

By Mr. Rob. Tredway, *n.* 232. p. 712.

2. We have lately diſcovered two *Hot Springs* in *Jamaica*, one to Windward, which ſeems ſulphurous; the other to *Lee-ward*, is very ſalt, but as I am told, does not partake of *Brimſtone*; and both very much magnified for the *Epidemick Diſeaſes* of theſe parts, the *Dry Belly-ach*, *Pains* of the *Nerves*, and *Yaws*.

Obſervations *concerning* Healing Springs, by Dr. J. Beal, n. 57. p. 1155.

XLII. Tho' the Particles of *Water* are ſo minute, that we cannot diſcern them with our Eyes, yet by *Feeling*, we may diſtinguiſh the acute and vigorous particles of *healing Waters*, from the languid and hurtful Particles of common *Waters*. The *healing Water* will intermingle with their Aſperities, ſuch an agreeable *Titillation*, as will invite us to rub in, or preſs on the cleanſing and terſive Water; and will, all along recompence the Pain of ſearching the Wound by their active Frictions, with ſuch ſpeedy Reparations, and ſuch indulgent Degrees of *Sanation*, as mitigates the Torment with ſtore and variety of pleaſures. Other common Waters, even thoſe of ſome of the pureſt and moſt cryſtalline Fountains, are almoſt poyſonous, encreaſing *Tetters*, and fomenting *Ulcers*, with an inward and ſullen Painfulneſs. This dextrous Water, by a moſt favourable *Chirurgery*, ſearches to the *bottom* of *old* and *cancerous ulcers*, ſweeps or ſhaves away the roots of *Tetters* and *Cancers*, and appeaſeth the unnatural *Rage*, and ſome of theſe *healing Waters* are benign, whether we apply them outwardly, or truſt them inwardly for the relief of our *Entrails* and *Vitals*. And by theſe remarkable *Indications*, and the Effects I have ſeen ſucceeding, I have been confirmed of the real Virtue of ſome of the (ſo call'd) *Holy Wells*, of oldeſt Reputation in *England*, and have diſcovered other *healing Springs*, whoſe Vertues were not much known, or noted before.

Our *Eyes* alſo may be in ſome ſenſe good witneſſes of peculiar *figures* in the *Particles* of thoſe *Spring-waters*, which are proper for the *Eyes*. They ſeem to ſcour the *Eyes*, as it were with ſharp, but very fine *Gravel*. And by this *Indication*, I have tried and found the Springs which are extraordinary for the Eyes, and perhaps to cleanſe *optick Glaſſes*. About 30 Years ago, in a very *hot* and *droughty* Summer, there was an *Epidemical Diſtemper* of Men's *Eyes* and *Eye-lids*; I found it ſo at *London* and *Weſtminſter*, and almoſt in every Houſe where I came, as I travell'd weſtward on both ſides *Severn*. *Verjuice*, or the Juice of *Crabs* was found the beſt Remedy, and where they knew it not, I gave notice of it, and all that try'd it, confeſs'd that it was not a very unpleaſant *Application*. Their *Eyes* had a fretting *Itch*, and *Verjuice* prov'd more agreeable than *Vinegar*, or *White wine*, or any other Liquor or Mixture Some ſuch tickling Pleaſure, but yet more delicate and tender, there is in ſome *Spring-waters*, which are for the *Eyes* peculiar.

The *Springineſs* of *Wool* more than of *Linen*, offers another viſible and tangible Demonſtration, how the ſtronger and quicker *Springs* of ſome Water more than of other, may conduce more or leſs to Healing; or may be more or leſs noxious, either inwardly taken or outwardly applied.

I knew one who was ſhot in his Heel with an Arrow, which carried with it a very ſmall rag of the *woollen Stocken*: This Rag not being found by the *Chirurgeons*, tho' they were then of the beſt Note, the Wound became for a Year or two incurable; and the Pain was ſo intolerable, that it was thought neceſſary to cut off his Foot. At laſt by chance the Rag was found, and taken away, and then the Cure was ſoon perfected. *Woollen* and *Linen* may have their Turns and Seaſons; the one as a *Mechanical Operation* for *Heating* by a cloſe and permanent *Friction*, the other as a quiet *Lenitive*. Our tender Skin can hardly bear the inceſſant *ſpringineſs* of *wooll*, in a deep wound we can leſs endure it. But the Springs of ſome Waters may be lined with a ſofter Liquor than the hairy and curled Filaments of *Wooll*; and hence we may perceive how ſome waters may by their rolling Particles be the greateſt *Probes*, and yet the ſureſt Searchers, Cleanſers and Healers. And hence alſo on the contrary, we may ſee how ſome Waters which cure *Ulcers* and *Cancers* by outward Application, may be too buſily corroſive and dangerous if taken inwardly.

I think I may note, that generally all the Springs in *England* that are of very ancient Eſteem for Healing, and were commonly call'd *Holy Wells*; ſuch as St. *Winifred*'s *Well* in *Flintſhire*, of which I never made Trial, but it carries the greateſt Fame, are all very pure, and yield no kind of *Sediment*. In this our *Hot Baths*, and perhaps ſome few mineral Springs are to be excepted. I muſt yet be more particular.

I know a *Spring*, which the old People there call their *Holy Well*, on the ſide of a low Hill, in an arable Field, which (beſides the *Healing Qualities*) hath an extraordinary efficacy in clearing the *Skin* from *Sun burnings*, and *Freckles*; and addeth as much luſtre as agrees with the finer Art of concealing Art, and with Modeſty; and after waſhing 2 or 3 Mornings it makes the Skin as ſmooth as Glaſs. It paſſeth thro' a Vein of light *Sand*, if I may call it *Sand*, 'tis more like to ſome kind of blueiſh criſped *Marle*, 'tis ſo light and hollow, as if it were freſhly working by ſome Ferment; and 'tis full of very ſmall and thin *Lamina*, ſeeming to be *metalline* and *bright* like the pureſt *Silver*, but the *Refiners* could not find it to be of any *value*. I was inquiſitive to ſearch it out, whether this *Water* had the *Beautifying Property* from the ſilver-like *Lamina*, or rather gave thoſe Veins of the *Earth* that *Tincture* and *Ferment*. Only two things I can affirm: 1. I ſaw many Springs opened in the lower grounds, which ſeemed in all appearance to run from the ſame Head, and had alſo the ſame very bright Ferment in their Paſſages, where they were opened, but theſe had nothing of the ſame property for

Healing or for *beautifying*, as I found by many trials, more than daily for ſome Years together. 2. The common Fields adjoining had on their Clods and Fallows, ſomewhat of the ſame glittering much faded, but enough to dazle their Eyes that fixed them on it in a bright *Sun-ſhining*. May not ſome *ſubterranean ſteam* give the *Tincture*, both to that vein of Earth thro' which it paſſed more freely; and alſo more forcibly to that Spring, by a greater reſort, or by ſome advantage it got by the *Aſcent* of the Ground, (And we commonly find theſe *healing Springs* either near the Top, or on the ſide, or near the Foot of ſome Hill, or running from the Hill:) And thus the *ſteams* reverberated and daſhed down by the motion of the Air, and by the *weight* of the Atmoſphere, may beget the ſame *metalline Tincture* in the adjacent Fields. This was far enough from yielding Sediment, and it had a pleaſing Smoothneſs, and was very inoffenſive to the Stomach; but it ſearched the Eyes ſomewhat ſmartly, and cleared them ſpeedily, and was generally commended for many *Healings* both inwardly and outwardly, and was every Way much more pleaſing than tormenting.

Within 2 Miles of the ſame, is another of their old *Holy Wells*, on the Brow of ſuch another Hill in an arable Field, within half a Mile of the lofty *Malvern* Hill: This is very kind for the Eyes, and hath alſo done many Cures upon Putrid and fœtid Ulcers, which were many Years deplored for incurable, as I can affirm upon my own Knowledge. I have ſeen it tried often, and always to good Effect; ſometimes conſiderably wonderful. *Vid. ſup. §. xxvi. 4.*

Many drink of it, and much extol it for Healings: And I never could hear of any that complained of hurt done by it. It was ſomewhat aſperous, but pleaſing in malignant Ulcers.

But much greater is the Reputation of the *Holy Wells*, as they call them, on the ſide of *Malvern Hills*, which Hills divide *Worceſterſhire* from *Herefordſhire*. The higher Spring is peculiar for the Eyes: About a Furlong lower is the *Healing Spring*; this cureth many Maladies and Cancers, if applied before the ſtrength of Nature be overthrown. I have read in the Monuments belonging to the *Hoſpital* at *Ledbury* a Town in the Way from *Hereford* to thoſe Springs, that a Biſhop ſome Ages paſt, endowed that Hoſpital with Revenues for the entertainment of diſtreſſed Paſſengers that travelled to thoſe Springs for Relief. 'Tis above 50 Years ſince I heard a panick Story ſpread all over the City and Country of *Worceſter*, the *Phyſicians* had poyſon'd thoſe Wells. I am perſwaded, that the ground of this Fable was only this; After more than ordinary Rain, for 1. 2, or 3 Years together, (as it falls ſometimes in *England*, ſome *common Waters*, by a part of the ſame or ſome other Channel, do drive to the ſame Aperture and drown the Excellency of the *Healing Water*. In this droughty Year (1669) we find, that many excellent Springs have loſt more than half, and ſome more than 4 parts of 5 of the Waters which they did uſually afford in the ſame Seaſons of the other moiſter Years; and the remaining *Waters* have the ſtronger Efficacy. Of this *Expectation* from long Droughts I formerly advertis'd you. And 'tis now *remarkable*, that the better *Springs*, which are on the Side of Hills, and on the higher ground, do maintain their *Current* much better than thoſe which are in the lower Vale. 'Tis ſo in many places about us here, when the better Springs had loſt 4 parts of their Current, many of the lower Springs were quite dried up. All theſe Waters are purely limpid, free from all Sediment, very terſive and ſearching, moſt effectual at the *Spring-head*.

I omit many other *Healing Waters*, that I may give you a brief touch of ſuch *Mineral*, *Saline*, and *medicinal Waters*, as I have found, or heard of in our Neighbourhood, namely about *Yeovil* in *Somerſetſhire*. I lately heard of 2 more *metalline Springs* in *Dorſetſhire*, beſides that of *Farrington*; perhaps their Virtues and their Fame are increaſed by this Drought. The *ſaline Spring* mentioned by Dr. *Highmore* to be at *Eaſt-Chenock*, is about 3 Miles hence weſtward. In a very droughty Summer I found it *ſtrong Brine*. But there is a *Salt-ſpring* of far greater worth at *Everich*, about 12 Miles hence towards *Shepton-Mallet*. The Pool which yieldeth *Vitriolate Salt*, is in *Sock-Dennis*, 3 or 4 Miles from hence weſtward. 'Tis not a great Pool, nor above 10 foot ſquare. Whether the Salt proceedeth from a Spring, or from a Vein of *vitriolate Earth*, I cannot yet determine; but the Mud and Earth about it is as blew as any *Roman Vitriol*. In a long laſting and hard Froſt, I ſent for a quart Bottle of the *Water*, and found it very thick and blackiſh, and it ſcented intolerably ſtrong, not much unlike Gunpowder newly inflamed. Cloſe adjoining unto this Town of *Yeovil*, were two Springs kind for the Eyes; the one in a Paſture, the other within a Bolt-ſhoot in a Field.

Vid. Inf §. XLIV. 2.

Vid. ſup. §. XXX. 3.

The old People prefer that in the Paſture before the other, as they have it from elder Tradition, and their pretended experience. And at this time, the more commended Spring, which is in the Paſture, and on the ſide of a riſing ground, runs freely; the other is newly dried up. 'Tis not every ſlight *gravelling* of the *Eyes* that ſufficiently indicates an extraordinary *Eye-water*; many good Springs have a degree of *Terſiveneſs*; but that which is extraordinary, hath a Friction ſomewhat permanent, and is in the end gratifying. We have alſo, cloſe by our Town, a Spring called *Ruſty-well*, where it breaks out, and where it firſt falls, it tingeth the Stones of the Colour of *Ruſty Iron*, and it hath the Smell ſtrongly, and ſeemeth to taſte of *Ruſty Iron*, yet 'tis as clear as any Water, and I tried it for a Month or more in my Study, putting *Corniſh-ſlate* and Pebbles to it in a Glaſs, and it gave no Tincture at all to the Stones, nor any Sediment; ſo that I ſuſpect the Tincture to proceed from ſome Effluvium mingled with the Water, at firſt Opening; but I confide not much in the ſingle and ſhort Trial I made. Some old Men boaſt of many great Cures it hath done.

Our Fore-fathers and very old men, ſcarce heard of the Name of the Scorbute; 'Tis a ſeaſonable Providence, if, ſince that Diſeaſe is become ſo Epidemical, the Remedy ſhould be ſo obvious and vulgar, as is pretended to be by ſuch Ferruginous Springs.

This breaks out near the foot of a lofty Hill, which continues, with ſome leſſer Falls, about 3 Miles weſtward to *Hamden Quarrey*, where they dig a hard Freeſtone of a dark yellow Colour. At *Weſt Camel*, 5 Miles hence, Northward, is a very fœtid black Spring, which tingeth ſilver black immediately; and I am told, that about 10 miles hence, more eaſtward, near

Wine-Caunton, not many Years ago, they digged for *Coal*, where the Coal-Men were endangered by a *Fœtid Damp*; And when they aſſayed the Coal in the Fire it proved very Noyſom, ſo that they forſook thoſe Cole-Mines. Perhaps it may be ſerviceable to them that know not how to make an honeſt uſe of *Arſenic* and other *Poyſons*.

Here again, with ſome Timorouſneſs, I propoſe the Inquiry, whether *Subterraneous Steams* might not give the *Dark Yellow Tincture* to the *Hamden Quarrey*, and the property to this Water of *Ruſty-well* for the *Fulvous Coloration*: It cannot be expected, that Materials, differing ſo much as Stones ſeem to differ from *Water*, when perfectly Petrefyed, ſhould retain the very ſame Colour, through both received it from the very ſame *Steams*. The ſame I propoſe for the Blackneſs and Fœtidneſs of the Spring in *Weſt-Camel*, and of the Coal near *Wine-Caunton*, that both may receive the ſame *Tincture*, and *Odour* from *Subterranean Steams*, which may perhaps be of ſo many kinds, and mixtures, as to cauſe much of the great diverſities of *Metals*, *Minerals*, *Earths*, and *Soils*; and of ſome minute Differences in the *Colour*, *Taſte*, *Odour*, and *Dreſs* of *Vegetables*; Yea and of the *Furres*, *Haires*, *Wool*, and other little varieties in *Animals* (particularly in *Sheep*) in ſeveral places; more immediately in *Vegetables*, and of *Animals* by Remoter circumſtances; I will not except the *Ethiopick Hue*, and *Humours* of Men in *Diſtant Climates*, though *Vegetables* and *Animals* do, for the moſt part, retain their *Seminal Properties* in *Diſtant Climates* for many Generations. And perhaps from theſe *Terreſtrial Steams* the *Vegetables* do imperceptibly draw ſome of their *Salts* and much of their *Nutriment*.

For theſe *Overtures* I will at preſent inſtance no more than thus. The Illuſtrious Mr. *Boyle* hath, methinks, evinced, that the moſt Solid Bodies we know, have their *Atmoſpheres* of *Steams* and *Exhalations*: And whatever the Materials be, which are under our *Terrene-Cruſt* towards the Center, whether Fluid, Flaming, or groſs Subſtances, they muſt needs hold an Intercourſe of *Tranſpirations*, and mutually operate by their perpetual Agitations, and Whirlings about: And by the *Vulcano's*, frequent in *Japan*, and in ſeveral other places, and by the *Heats* in deepeſt Mines, and by many other manifeſt Arguments, it appears, that there are always ſtrong *Steams* Aſcending towards the Surface of the Earth: And, if their *Generative Power*, and other Efficacies were duly examined, and proſecuted to the beſt purpoſes, we might perhaps in time find them to have a greater Virtue, and more uſeful for us, than many of the *Conſtellations* and *Celeſtial Influences*, which make no ſmall Noiſe amongſt *Aſtrologers*.

Obſervations on Boyling Fountains *and* Subterraneous Steams, *By Dr.* Tancred Robinſon. n. 169. p. 922. n. 172. p. 1038.

XLIII. Viſiting the Famous *Boyling Fountain* at *Peroul*, not far from *Montpelier*, I found the Water to Heave, and Boyl up very furiouſly in ſmall Bubbles; which manifeſtly proceeded from a Vapour breaking out of the *Earth*; for upon digging any where near the Ditch, and pouring other *Water* upon the dry place newly Dug, I obſerved in it immediately the ſame *Boyling*, as the Exquiſite Naturaliſt Mr. *Ray* has related in his Travels. The like Bubbling of Water is alſo found round about *Peroul*, upon the Sea-ſhore; and in the *Etang* it ſelf. But when I had taken ſome of the Sand and Earth out of the Fountain and Ditch, and put it into Veſſels, pouring the ſame Water upon it, there did not appear the leaſt *Perturbation* or Alteration thereupon; the Superficies of the *Water* continuing very ſmooth, equal, and quiet. And for further ſatisfaction, I ſought out, and diſcovered in ſeveral dry Places of the Ground thereabouts, many little *Ventiducts*, Paſſages or Clefts, where the Steam iſſued forth; at the Mouths of theſe Channels or Pipes, placing ſome light Bodies, as *Feathers*, ſmall thin pieces of Straws, Leaves, *&c.* I found them ſoon Removed away. This Vapour upon the Application of a lighted Candle, or Torch, did not Flame, or catch the leaſt Fire; n. 172. p. 1038. as the Fumes running through a Boiling Spring near *Wigan* in *Lancaſhire* do, with which thoſe Burning Fountains near *Grenoble* in *Dauphine*, near n. 169. p. 923 *Cibinium* or *Hermanſtadt* in *Tranſylvania*, near *Chermay* a Village in *Switzerland*, in the Canton of *Friburg*, and that not far from *Cracovia* in *Poland*, do agree in many particulars. Many *Hiſſing* Springs Bubbling at the Top, I have found in *Switzerland*, (the beſt watered Country that ever I ſaw) and in many places near the *Rhine*. The like is related by *Varenius* near *Culma*, and by Dr. *Plot* in *England*. There are other *Boyling Waters* of a quit contrary Temper, being actually *Hot* to ſeveral Degrees, ſo as to Boyl Eggs, and many other Things put into them; as thoſe near the *Solfatara*, not far from *Naples*; as alſo upon the Top of Mount *Zebio* in the Duke of *Modena*'s Territories, not far from his *Villa* near *Saſſolo*; in the Source of the *Emperor*'s Bath at *Aken*, in the Country of *Juliers*, and in *Japonia*, mentioned by *Varenius*.

From the foregoing Hiſtory, we may take occaſion to reflect a little upon the manifold variety of *Exhalations* prepared in, and flying out from the vaſt *Magazines*, and ſeveral *Reconditories* below, as to their Qualities and Effects; ſome being *Cold* and *Dry*, reſembling Air or Wind, as thoſe near *Peroul*, and in the *Caverns* of Mountains, eſpecially thoſe of *Æolus* and other Hills of *Italy*; as alſo in Mines upon the meeting of *Water*. Others are *Inflammable*, and of a *Bituminous* Nature, though not actually *Warm*, as thoſe near *Wigan* in *Lancaſhire*. There are alſo many *Steams* very *Hot*, *Sulphurous*, and *Saline*; more eſpecially thoſe in the natural *Stoves*, *Sweating-Vaults*, *Grotts*, *Baths*, and the *Vulcano*'s near *Naples*, *Baja*, *Cuma* and *Puzzuolo*, as alſo in ſome of the *Subterraneous Works* at *Rome*. Others there are of an *Arſenical*, and ſuch like venomous Qualities, as in the *Grotto del Cano*, on the Bank of the *Lago Agrano*; in many Mines, in Poyſonous Springs and Lakes.

Now theſe various Steams meeting with, and running through *Waters*, muſt cauſe a great variety of *Phænomena* and Effects in them. Whether this great Diverſity proceeds from the various *Breaths* of the *Pyrites*, and the *Lapis Calcarius*, whilſt under their different States, and Changes, or from other n. 172. p. 1039. ſorts of *Effluviums*, I dare not determine: But I am apt to believe that there Vid. l. f. Cap. III. may be Veins of the *Pyrites* near thoſe Places, the *Inflammability* of which *Mineral* hath already been diſcourſed of, and made very clear by Dr. *Liſter*.

An Ingenious Author relating the Hiſtory of a Burning Fountain in the *Palatinate* of *Cracovia*, affirms, that upon *Evaporating* the Water, a Dark or Pitch like Subſtance may be extracted, which cures the moſt *Inveterate Ul-*

cers

ers in a very ſhort time; and that the Mud it ſelf is very Powerful againſt *Rheumatick* and *Gouty Pains*, *Palſies*, *Scabs*, *&c.* The Inhabitants of an adjacent Village, drinking much of this Spring, do generally Live to 100 or 150 Years, which he Attributes to the ſanative Virtue of the *Water*.

The *Naptha*, or *Bituminous* Subſtance floating upon a Spring at *Pitchford* in *Shropſhire*, and upon *St. Catherine's Fountain* near *Edinburgh*, hath been ſucceſsfully uſed in *Ulcerous* and *Cutaneous* Diſtempers. Many ſuch like Fountains of *Petroleum*, and *Oily Subſtances*, are to be met with up and down; as in the Iſland of *Zant*, very plentifully; near *Gabian* in the Road from *Montpelier* to *Beziers* in *Languedock*; in the *Valtaline*, ſubject to the *Griſons*; at the Foot of Mount *Zebio* in the Dutchy of *Modena*: Not to mention any of the Places written of already by *Varenius*. The Inhabitants living near theſe Fat Oily Springs, take great care to gather and ſeparate the *Bituminous Subſtances* from the *Water*, making very conſiderable Advantages of them, for *Mechanical* and *Medicinal* Uſes. I have ſeen them gather it up with Ladles, and put it into large Filtres, or into great Funnels ſtopt at the *bottom*; or elſe into Barrels ſet on one end, which have Spiggots near their Bottoms; when they are full and have ſtood a while, they open the Spiggot or Stoppel to let out the *Water*, and when the Oil or *Bituminous Subſtance* begins to come, they preſently ſtop it again.

XLIV. 1. The Salt Springs at *Hall* in *Saxony*, are 4 called *Gutiaar*, the *Dutch* Springs, the *Wettritz*, and the *Hackel-dorn*. The 3 *firſt* hold above 7 parts of Salt, 3 of *Marcaſites* and 14 of *Water*. The laſt holds leſs, but yields the Pureſt Salt.

Salt Springs *at* Hall *in* Saxony, *and at* Lunenburg; *By* . . . n. 8 p. 136.

They are, (beſides their Oeconomical uſe) employed, Medicinally to Bath in; and to draw a Spirit out of it, exhibited with good ſucceſs againſt *Venom* and the *Putrefaction* of the *Lungs*, *Liver*, *Reins* and *Spleen*.

The Salt Water at *Lunenburg*, being more Greeniſh than White, and not very *Tranſparent*, is about the ſame Nature, and holds with that of *Hall*. It hath a mixture of Lead with it, whence alſo it will not be Sod in Lead Pans; and if it held no Lead at all, it would not be ſo good, that Metal being judged to Purifie the Water; whence all the Salt of *Lunenburg* is preferred before all others, that are made of Salt Springs.

2. I made *Tryal* of that Salt Spring at *Eaſt Chenock* in *Somerſetſhire* (above 20 Miles from the (Sea,) which tho' not ſo *Salt*, by reaſon of the late *Rains*, as in *Summer*, yet from a *Wine Quart*, by *Evaporation*, we obtained near 80 *Grains*.

In Somerſetſhire; *By Dr.* Highmore n 56. p. 1130

3. At *Salt-Water-Haugh* near *Butterby*, about a Mile and a half from *Durham*, in the middle of the River *Weare*, riſes a Salt Spring. It is good to be ſeen and taſted, only in the Summer time, when the Water is diſcharged all on one ſide of the Channel: For in Winter, when the River is high it loſes its Salt in the freſh Streams; ſo that they are not perceivable. The Water ſeems to Bubble up equally in all parts in the Channel, for the ſpace of 40 Yards in length, and about 10 in breadth. The Salteſt of all the Springs iſſues out of the middle of a Rock, the Surface of which was manifeſtly Saltiſh; and which, in a hot Day, as I was told, would be all covered over with a perfect Salt. I had all the Water laved out of the place

In the Biſhoprick *of* Durham; *By* Mr. Hugh Tod n. 163. p. 726.

where it ſeemed to ſtagnate, and immediately out of the Body of the Rock there Bubbled up Water, as ſalt as the former. It was as high as any Brine can be, and tho' but little in quantity in compariſon of the Freſh River, yet of that force to give a Brackiſhneſs to the Streams a hundred Yards below. Thoſe that have boyl'd this Brine ſay that it affords a great quantity of Bay Salt not ſo Palatable, yet as Uſeful or Ordinary Salt is. It *Tinges* all the Stones with a Red Colour. The Sea is 8 Miles off, where neareſt.

Salt Springs *and* Salt-Making *at* Nantwich in Cheſhire; *By Dr.* Will. Jackſon. n. 53. p. 1060 n 55. p. 1128 n. 54. p. 1077

XLV. The Depth of the Salt-ſprings is in ſome places not about 3 or 4 Yards: In *Nantwich*, the Pit is full 7 Yards from the footing about the Pit; which is gueſſed to be the Natural height of the Ground, though the Bank be 6 foot higher, accidentally raiſed by Rubbiſh of long Making Salt, or Walling, as they call it. In two places within our Townſhip the Springs break up ſo in the Meadows, as to Fret away, not only the Graſs, but part of the Earth, which lies like a breach, at leaſt half a foot or more lower than the *Turf* of the Meadow, and hath a Salt Liquor, Ouſing as it were out of the Mud, but very gently.

Our Country is generally a low Ground, witneſs the Name given to it, the *Vale Royal* of *England*; yet it is very full of Collicular Eminencies, and various Riſings to diſtinguiſh it from being all Meadow. The neareſt Hills (of thoſe worth calling Hills) is about 7 Miles diſtant from the Springs; it is ſteeper but not much higher than *Highgate-Hill*.

We have alſo a peculiar ſort of ground in this County and ſome Adjacent Parts, which we call *Moſſes*: And they are a kind of Mooriſh Boggy ground, very ſtringy and Fat; which ſerveth us very well for *Turfs*, cut out like great Bricks and dried in the Sun. And this kind of ground is ſo much here, that there are few *Townſhips* but they have their particular *Moſſes*. In theſe is found much of that Wood we call *Firr wood*, which ſerves the Country People for Candles, Fewel, and ſometimes for ſmall *Timber Uſes*; and this the Vulgar concludes to have lain there ſince the *Flood*. But generally theſe *Moſſes* ſeem to be places undermined by ſome *Subterraneous Streams*; or by the Diſſolution of ſome matter, that made them equal with the reſt of the ground formerly: In which conjecture I am confirmed by this, that near a place of my Lord *Cholmondeley's* called *Bilkely*, about 9 or 10 Years ſince, not far from one of theſe *Moſſes*, without any Earthquake, a piece of ground, about 30 Yards over, fell in with on huge noiſe, and great *Oaks* growing on it Fell in with it together; which hung firſt with part of their Heads out, afterwards ſuddenly ſunk down into the grounds, ſo as to become Inviſible: Out of which Pit they drew Brine with a Pitcher tied to a Cart-rope, but could then find no *bottom* with the Ropes they had there: Since, the Pit is filled up with Water, and now doth not *Taſte* ſalt, but a very little Brackiſh, a very ſmall Rivulet paſſing through it. The neareſt Salt-ſprings to this place are at *Durtwich* about 3 Miles from it.

Our Springs are about 30 Miles from the Sea; and generally lie all along the River *Weever*: Yet there is an appearance of the ſame *Vein* at *Middlewich* nearer the River *Dane* than *Weever*; which notwithſtanding ſeems not to be out of the Line of the *Weever's Stream*; and theſe lie all near Brooks, and in the Meadowiſh grounds.

I could obſerve no Singularity at all in the Plants; for, where the Salt reaches the Surface, it Frets away all (as I ſaid before) and upon the *Turf*, near the old decayed Pits, grows the very ſame, that doth in the Remoteſt place of the Meadow; only I obſerve, that where the *Turf* was Fretted away, Ruſhes maintained their ſtation longeſt.

The Water is ſo very Cold at the bottom of the Pit, that when the Briners ſometimes go about to Cleanſe the Pit, they cannot abide in, above half an Hour, and in that time they Drink much Strong Water. There is not any Hot-Springs (that I can hear of) nearer us, than *Buckſton-well*, which is about 30 Miles diſtant.

Several new Brine Springs have been of late both ſought and found; yet none knows of any Shells, but rather a Blackiſh Slutch mixt with the Sand, which infects the whole Spring (like the *Scuttle Fiſh*) Black, when 'tis ſtirred; elſe the Water runs very clear.

The Springs are Rich or Poor in a double Senſe; for a Spring may be Rich in Salt, but Poor in the quantity of Brine it affords. Thus they have a Rich Brine in their chief Pit at *Middlewich*, which yields a full *4th* part of Salt, yet is it ſo Thrifty of it's Brine that the Inhabitants are Limited to their proportions out of it, and their Quantity is ſupplyed out of Pits that afford a Weaker Brine. Our Pit at *Nantwich* yields about 1 pound of Salt for 6 pound of Brine; but then 'tis always, without any ſenſible difference, ſo Plentiful a Spring, that whereas they ſeldom *Wall*, that is *Make Salt*, in above 6 Houſes at a time, and there are or ſhould be about 50 *Wich Houſes* in the *Town*, this Pit is judged ſufficient to ſupply them all, without falling much lower than a Yard or two at moſt. And this Advantage would accrew over and above, that ſuch quick uſe of the Pit extreamly ſtrengthens the Brine, perhaps to a degree little leſs than that of *Middle-wich-Pit*: For, I have tryed it my ſelf, that a Quart of Brine, when the Pit had been drawn off 3 or 4 Days firſt to ſupply 5 or 6 *Wich-houſes*, hath yielded an Ounce and an half more of *Salt*, than at any other time, when it hath had a reſt of a Week or thereabouts.

Mar. 8. 1668. I weighed 2 Pounds of Diſtilled Water in a Narrow-mouthed Glaſs bottle, that I might take an exact Mark for a Quart. This Bottle being filled with our Brine to the very ſame Mark, weighed (beſides the *Tare* of the Bottle) 2 Pound 3 Ounces and 5 Drachms. This was taken up when the *Wich houſes* began to Work, ſo that the Pit was but little drawn. I filled up the Bottle with the ſame Brine, and it weighed juſt 3 Drachms more. This Brine, boyled away, without any Addition or Clarification, made 5 Ounces and 4 Drachms of Salt. Five Days after, when the Pit had been drawn all that while for the working of the *Wich-houſes*, vid: *Mar.* 13. the ſame Bottle fill'd to the Quart Mark aforeſaid with Brine then taken up, weighed, beſides the Bottle, 2 Pounds 4 Ounces and an half: The ſame time, the Bottle filled as in the former Experiment, weighed juſt 2 Pounds and a half, which is, 3 Drachms more than the Quart Mark before; which boyled into *Salt* made 6 Ounces, 6 Drachms and 2 Scruple: Which exceeds the former quantity of *Salt*, 1 Ounce, 4 Drachms and 2 Scruples, through the Brine exceeded the former in weight but 4 Drachms.

By which Tryal I confuted alſo a Tradition, which the Briners have amongſt them, *viz.* that the Brine is ſtrongeſt at the time of the *Spring Tides*, to wit, at the Full and Change of the Moon. For *Mar.* 8. aforeſaid was only one Day paſt the Full, and then the Brine was weaker than it was the 13th Day, when 'twas 6 Days paſt the Full. So that I conclude there could be no other Reaſon, than that the much *Drawing* makes way for the *Salt Springs* to come the quicker, and allows the leſs time for the admiſſion of *Freſh-Springs*. But 'tis obſerved by the Briners that they make more *Salt* with the ſame quantity of Brine in dry than in wet *Seaſons*.

Their manner of *Working* is this: They have formerly boiled their Brine in 6 *Leaden Pans* with Wood Fire; upon which account they all *Claim* their intereſt in the Pit by the Name of ſo many 6 *Leads Walling*; by which they each know their Proportion; but in the memory of many alive they changed their 6 *Leads* into 4 *Iron Pans*, ſomething better than a *Yard Square*, and about 6 Inches deep, ſtill fitting the Content of theſe to that of the 6 *Leads*: And of late many have changed the 4 *Iron Pans* into two greater; and ſome *Wall* but in one: But ſtill the Rulers Gage it to their Old Proportions.

They uſe for their *Fewel* Pit Coals, brought out of *Staffordſhire*. Theſe *Pans* are ſet upon *Iron Bars*, and made in on all ſides, very cloſe (that the *Flame* nor *Smouk* break through) with *Clay* and *Bricks*. They firſt fill their *Pans* with Brine out of the *Pit*; which comes to them in ſeveral *Wooden Gutters*: Then they put into their *Pans* amongſt their Brine a certain mixture, made of about 20 Gallons of Brine and 2 quarts of *Calves*, *Cows*, or chiefly *Sheep*'s Blood, mixt into a *Claret* Colour: Of this mixture they put about 2 *Quarts* into a *Pan* that holds about 360 *Quarts* of Brine; this Bloody Brine, at the firſt boyling of the *Pan* brings up a *Scumm*, which they are careful to take off with a Skimmer, made with a *Wooden Handle* thruſt through a long Square of *Wainſcot board*, twice as big as a good ſquare *Trencher*: This they
Fig. 63. call a *Loot*. Here they continue their Fire as quick as they can, till half the Bride be waſted, and this they call *Boyling upon the Freſh*. But when 'tis half boyled away, they fill their *Pans* again with new Brine out of the Ship, (ſo they call a great *Ciſtern* by their *Pans* ſides, into which their Brine runs through the Wooden Gutters from the Pump, that ſtands in the Pit;) then they put into the *Pan* 2 *Quarts* of the mixture following: They take a *Quart* of *Whites* of *Eggs*, beat them throughly with as much Brine, till they are well broken; then mix them with 20 *Gallons* of Brine, as before was done with the Blood; and thus that which they call the *Whites* is made. As ſoon as this is in they Boyl ſharply, till the *ſecond Scumm* ariſe; than they Scumm it off as before, and Boyl very gently till it Corn; to procure which, when part of the Brine is waſted, they put into each *Pan*, of the Content aforeſaid, about a *quarter* of a *Pint* of the beſt and ſtrongeſt *Ale* they can get; this makes a momentary *Ebullition*, which is ſoon over, and then they abate their Fires, yet not ſo but that they keep it Boyling all over, though Gently; for the Workmen ſay, that if they boyl faſt here, (which they call *Boyling on the Leach*, becauſe they

uſually all this time lade in their *Leach Brine*, (which is ſuch Brine as runs from their *Salt* when it is taken up before it hardens) it, I ſay, they boyl faſt here, it waſtes their *Salt*. After all their *Leach-Brine* is in, they boyl gently till a kind of Scum come on it like a thin Ice; which is the firſt appearance of the *Salt*: Then that ſinks, and the *Brine* every where gathers into *Corns* at the bottom to it, which they gently rake together with their *Loots*. I ſay gently, for which ſtirring breaks the *Corn*. So they continue till there is but very little Brine left in the *Pan*: then with their *Loots* they take it up, the Brine dropping from it, and throw it into their *Barrows*, which are Caſes made *Fig.* 64.
with flat cleft Wickers, in the ſhape almoſt of a Sugar Loaf, the bottom uppermoſt. When the *Barrow* is full, they let it ſtand ſo for an Hour and an half in the *Trough*, where it drains out all the *Leach-brine* aboveſaid; then they remove it into their *Hot Houſe* behind their Works; made there by 2 *Tunnels* under their *Pans*, carried back for that purpoſe. The *Leach-brine*, *Fig.* 65.
that runs from the Barrows they put into the next Boyling, for 'tis to their Advantage, being *Salt* Melted, and wanting only Hardning.

This Work is performed in 2 *Hours* in the ſmaller *Pans*, which are ſhallower, and generally boyl their Brine more away, wherefore their *Salt* will laſt better, though it does not *Granulate* ſo well, becauſe when the Brine is waſted, the Fire and the ſtirring breaks the *Corns*. But this *Salt* weighs heavier, and melts not ſo ſoon, and therefore is bought by them that carry it far. But in the greater *Pans*, which are uſually deeper, they are about half an Hour longer in boyling; but, becauſe they take their *Salt* out of their Brine, and only harden it in their *Hot Houſe*, its apter to melt away in a moiſt Air. Yet of this ſort of *Salt* the bigger the *Grain* is, the longer it endures, and generally this is the better *Granulated* and the Clearer, though the other be the *Whiter*. Upon which I rather think, 'tis the taking of the *Salt* out of the Brine before it be waſted, that cauſes the *Granulating* of it, than the Ale to which the Workmen impute it. This kind meaſures profitably well, therefore it is much bought by them who buy to ſell again.

They never cover their *Pans* at all; during their whole time of Boyling. They have their Houſes like Barns open up to the Thatch with a *Louver-hole* or two to vent the Steam of the *Pans*. Poſſibly Tiles may do better, but no Body is yet ſo curious as to try; but the Steam is ſuch, that I am confident no Plaiſter will ſtick, and the Board will Warp, and their Nails will ruſt ſo, as quickly to fret in pieces.

Without *Salt*, both *Beef* and *Bacon* is very well preſerved, ſweet and good a whole Year together; and I do apprehend this *Salt* to be rather more ſearching than *French Salt*, becauſe I have often obſerved that Meat kept with this *Salt*, ſhall be more fiery *Salt* to the midſt of it, than I have obſerved when I ve eaten powder'd Meat on Ship-board, which was probably done with *nch Salt*, I then being on the South ſide of *England*, and in a *Dutch* Veſſel. is certain *Cheſhire* ſends yearly much *Bacon* to *London*, which yet had never y mark of Infamy ſet upon it; and Hang'd Beef (which others call *Marmaſs-beef*) is as good and as frequent in *Cheſhire* as in any place; ſo that onclude, that this laſt is fully effectual for any Uſe, and as good as any ther.

The Sweepings of ſuch *Salt* is conſtantly ſhed and ſcattered about on the Floor, not without taking much of the Dirt, (which occaſions its *Grayneſs*) is called *Gray Salt*. This ſells not at half the Rate of *White Salt*, and is only bought up by the poorer ſort of People, and ſerves them in ſalting *Bacon*, courſe *Cheeſe*, *&c.* *Catts* of *Salt* are only made of the worſt of *Salt*, when yet wettiſh from the *Pans*; molded and intermixt with interſperſed *Cummin Seed* and *Aſhes*, and ſo baked into a hard Lump in the Mouths of their Ovens. The uſe of thoſe is only for *Pigeon-Houſes*. But *Leaves* of *Salt* are the fineſt of all for Trencher Uſe. There is no difference in the boyling of theſe from the common way of the fine *Salt*; but in the making up, ſome care is uſed: For firſt they cut their Barrows, they intend for *Salt Loaves*, with a long ſlit from top to bottom equally on both ſides; then they tye both ſides together with Cords; then they fill this Barrow with *Salt* boyled as uſually, but in the filling are careful to Ramm down the *Salt* with the end of ſome Wooden Bar, continuing this till the *Barrow* be fill'd to their Minds; then placing it ſpeedily in their *Hot Houſe*, there let it ſtand all the time of their *Walling*: Wherefore they prepare for their *Loaves* at the beginning of their Work, that they may have all the benefit of their *Hot Houſes*, and when theſe begin to ſlack, they take out the *Loaves*, and untye the Cords that faſtened the Barrow, that both ſides of the ſame may eaſily open without breaking the Loaf. They they take the Loaf, and bake it in an Oven where Houſhold Bread hath been baked, but now drawn forth. This they do twice or thrice, 'till they ſee it baked firm enough; and this being placed in a Stove or in a Chimny Corner, and cloſe covered with an Hoſe of Cloth or Leather, like the Sugar Loaf-Papers, will keep very White; and when they have occaſion to uſe any, they ſhave it off with a Knife (as you do Loaf-Sugar) to fill the Salt-ſeller.

Fig. 63. The Loot.

Explication of the Figures.

Fig. 64 *aa*. Two *Barrows* filled with *Salt*. *bb*. The Salt heaped above the top of the Barrows, and patted down hard. *C*. The *Leach Trough*.

Fig. 65. *aaaaaa*, The *Hot Houſe* between the Wall and the Chimney. *bb*, two *Tunnels*. *CC*, The Chimney-back, into which the *Tunnels* convey the Smoak. *dddd*, The 4 *Pans*. *E*, The Partition Wall between the *Pans* and the *Hot-Houſe*. *ff*. The *Fire-places*. *gg*. *Aſh-holes*. *hh*. The *Hearth* below. *ii*. The *Deſcent* to the *Hearth*.

At Droitwich in Worceſterſhire, *by Dr.* Tho. Raſtel. n. 142. p. 1059.

The Country is neither *Plain*, neither hath it any great *Hills*, but many ſmall Riſings, the greateſt Hills near us being the *Lichie* within 6 Miles, which ſome call *Look-high*, ſuppoſing it to be the higheſt Ground in theſe Parts, becauſe the Springs which riſe there, run into the North and South Seas; near to which are *Clent Hills*, about the ſame diſtance. On the other ſide the River *Severn*, are *Aberly* Hills at about 7 Miles diſtance from us. There are many Salt-Springs about the Town, which is ſeated by a Brook ſide, called *Salwarp-brook*, which ariſe both in the *Brook*, and in the Ground near it, though there are but 3 Pits that are made uſe of.

Where the Springs are Salteſt there grows nothing at all, but by the *Brackiſh* Ditches there grows *Aſter Atticus* with a pale Flower, which I find no where elſe with us.

Some of the *Salt-ſprings* riſe on the top of the ground, which are not ſo *ſalt* as others. The great *Pit* which is call'd *Upwich Pit* is 3 foot deep, in which are 3 diſtinct Springs riſing in the bottom, one comes into the Pit North-weſt, another North eaſt, the 3*d* South-eaſt, which is the richeſt both in Quantity and in Quality. They all differ in ſaltneſs, which I can give no exact Account of, it being impoſſible to ſeparate them, but there will be ſome mixture; the Pit is about 10 foot ſquare, the ſides are made with ſquare Elms jointed in at the full length, which I ſuppoſe is occaſioned by the *ſaltneſs* of the ground which appears to me to have been a *Bog*, the ſurface of it is made of Aſhes. That it was originally a *Bog*, I am induced to believe, for not many Years ſince, digging to try the Foundation of a *Seal*, (for ſo we call our Houſes we make Salt in) I thruſt a long Staff over head.

Tho' the *Brine* be colder than the other Water, yet it never freezeth, but the Rain Water that lies upon the Brine in extream hard Froſts, will freeze, but not much.

The *Soil* about the Town, on the lower ſide of it, is a black rich Earth, under which 2 or 3 foot is a ſtiff gravelly Clay, then Marle. Thoſe that make Wells for freſh Water, if they find Springs in the Marle, they are generally freſh; but if they ſink thro' the Marle, they come to a whitiſh Clay mixed with Gravel, in which the Springs are more or leſs brackiſh.

In the great Pit at *Upwich*, we have at one and the ſame time, 3 ſorts of *Brine*, which we call by the Names of *Firſt-man*, *Middle-man*, and *Laſt-man*; theſe ſorts are of different *ſtrengths*; the *Brine* is drawn by Pump, ſo that which is in the bottom is firſt pumped out, which is that we call *Firſt-man*, *&c.* That I might make an exact Trial of the ſtrength, I made me a Quart that contained 24 *Ounces Troy* of diſtill'd Water, which Quart being filled with the firſt *Brine*, beſides the Tare of the Quart weighed 29 *Ounces*, which made 7 *Ounces* and 3 *Drams* of *Salt* without any Addition; the next day I weighed the ſame Salt again, and it weighed 7 *Ounces* and 6 *Drachms*; ſo that 4 *Tuns* of *Brine*, make above one Tun of Salt. The ſame Quart filled with *Middle-man*, which is the ſecond ſort of *Brine*, weighed 28 Ounces, I alſo weighed a Quart of *Brine* as it came immediately out of the Springs, which weighed 28 *Ounces*, and the 3d ſort 27 *Ounces*, ſo that what the firſt gets, the laſt looſeth, which doth precipitate as much in 24 Hours, as if it ſtood a much longer time.

The quantity of *Brine* that this Pit yields every 24 hours is as much as will make 450 Buſhels of Salt, which is drawn out twice or three times a Day, for ſo oft we ordinarily draw, and that as long as the Pump will go.

In the beſt Pit at *Netherwich*, a quart of *Brine* weighs 28 *Ounces*, and an half; this Pit is 18 Foot deep, and 4 Foot broad, and yields as much *Brine* every 24 Hours as makes about 40 Buſhels of Salt, there is but one Spring in the Pit, that comes in 2 Foot and 8 Inches above the bottom.

The worſt Pit at *Netherwich* is of the ſame breadth and depth as the former; a quart of Brine out of which, weigheth 27 *Ounces*, and yields as much *Brine* daily as makes about 30 Buſhels of Salt. In this Pit are 3 *Springs*, two in the bottom, and one about 2 Foot higher. Theſe Pits are within 6 Yards of one another.

Theſe Pits are near the *Brook*, the great Pit on the North ſide, and about a quarter of a Mile lower, the 2 leſſer Pits on the South-ſide.

In the great Pit I found no Variation either in Quality or the Strength of the *Brine*, but the Springs in the other Pits are augmented by much Rain, and yield leſs Salt.

That every Man may know his own Proportion, the Brine is divided into *Phats Wallings*, a *Phat Walling* is divided into 12 *weaker Brines*, and every *weaker Brine* is divided into 8 *Burdens*, every Burden being a Veſſel that contains about 32 Gallons, whereof every one hath 6 Burdens of *Firſt-man*, 6 of *Middle-man*, and 6 of *Laſt-man*, ſo that every Man hath not only his juſt Proportion in Quantity, but in Quality alſo. This Brine is carried in Coolers to every Man's Seal, by 8 ſworn Men, which we call *Maſters* of the *Beachin*, and 4 *Middle-men*, and there put into great Tuns for Uſe.

The Fewel heretofore uſed was all Wood; but ſince the Wood hath been deſtroyed by the iron works, we uſe almoſt all Pit-coals, which are brought to us by Land 13 or 14 Miles.

The *Phats* we boil our *Brine* in are made of *Lead*, caſt into a flat Plate at 5 Foot and an half long, and 3 Foot over, and then the ſides and ends beaten up, and a little raiſed in the middle, which are ſet upon *Brick-work*, which we call *Ovens*, in which is a Grate to make the Fire on, and an Aſh hole, which we call a *Trunk*; in ſome *Seals* are 6 of theſe *Pans*, in ſome 5, and ſome 4, ſome 3, ſome 2. In each of theſe Pans is boiled at a time, as much Brine as makes 3 Pecks of white Salt, which we call a *Lade*, and is laded out of the *Pan* with a *Loot*, and put into Barrows, which are ſet into *Baſtals* over Veſſels we call *Leach-combs*, that the Brine may run from the ſalt; which Brine we call *Leach*, with which we dreſs our *Phats*, when the cold Brine they are firſt filled with is ſomething boiled away. In theſe *Baſtals* the ſalt ſtands till it's dry, which is about 4 Hours; then we carry it into *Cribs*, which are Houſes boarded on the bottom and ſides, where it is kept till ſold, which is ſometimes half a year, or 3 quarters; in which time, if the *Crib* is good, it will not waſte a 12th part, the ſalt it ſelf being of ſo ſtrong a Body: Whereas in *Cheſhire*, they are forced to keep their Salt in Barrows in Stoves to dry it, and make it no faſter than they ſell.

For *clarifying* the *Brine*, we uſe nothing but the *Whites* of *Eggs*, of which we take a quarter of a *White*, and put it into a Gallon or two of Brine, which being beaten with one's Hand, lathers as if it were Sope, a ſmall quantity of which *Froth* put into each *Phat*, raiſeth all the ſcum, (ſo that the *White* of an *Egg* will clarifie 20 Buſhels of Salt, by which means our Salt is as white as any thing can be, neither hath it any ill Savour, as that ſalt hath that is clarified with Blood.

For *granulating* it, we uſe nothing at all, for the *brine* is ſo ſtrong of it ſelf, that unleſs it be often ſtirred, it will make ſalt as big grain'd as *Bay-ſalt*. I have boil'd *brine* to a *Candy height*, and it hath produced *Clods* of *Salt*, as clear as the cleareſt *Allum*, like *Iſle* of *May Salt*, ſo that we are neceſſitated to put a ſmall quantity of *Roſin* into the *Brine*, to make the Grain of the Salt ſmall.

Beſides the *white Salt*, we have another Sort which we call *Clod-ſalt*, which grows to the bottom of the *Phats*, that after the *White-ſalt* is laded out, is digged up with a Picker, which is made like a *Maſon's Trowel*, pointed with Steel, and put upon a ſhort ſtaff, this is the ſtrongeſt Salt I have ſeen, and is moſt uſed for ſalting *Bacon* and *Neats-Tongues*, it makes the *Bacon* redder than other ſalt, and makes the Fat eat firm; if the Swine are fed with *Maſt*, it hardens the Fat almoſt as much as if fed with *Peaſe*, and ſalted with white ſalt. It is very much uſed by Country-women to put into their *Runnet pots*, and, as they ſay, is better for their Cheeſe. Theſe Clods are uſed to broil Meat with, being laid on Coals. We account this ſalt to be too ſtrong to ſalt Beef with, it taking away too much of its ſweetneſs.

A third ſort of Salt we have, which we call *Knockings*, which doth candy on the *ſtails* of the Barrow, as the Brine runs from the Salt, after it is laded out of the *Phats*. This ſalt is much uſed for the ſame uſes as the *Clod-Salt*, tho' it is not altogether ſo ſtrong.

A fourth ſort we have, which we call *Scrapings*, that is, a courſe ſort of ſalt that is mixed with Droſs and Duſt that cleaves to the Tops of the ſides of the *Phats*; this ſalt is ſcraped off the *Phats* when we reach 'em, that is, when we take out *Phats* off the Fires to beat up the bottom, and is bought by the poor ſort of People to ſalt Meat with.

A Fifth ſort is *Pigeon-ſalt*, which is nothing but the Brine running out through the Crack of a *Phat*, and hardens to a Clod on the outſide over the Fire.

Laſtly, the *Salt-loaves* are the fineſt of white Salt, the Grain of which is made ſomething finer than ordinary, that it may the better adhere together, which is done by adding a little more Roſin, and is beaten into the Barrows when it is laded out of the *Phat*.

Our Salt is not ſo apt to diſſolve as *Cheſhire Salt*, nor as that Salt that is made by diſſolving *Bay-ſalt*, and clarifying it, which is called *Salt* upon *Salt*, which appears by our long keeping it without any Fire.

I believe there cannot be better *white Salt* than ours for ſeveral Reaſons.

1. There is none can be whiter, and conſequently more free from droſs.

2. It is the weightieſt as I have ſeen my ſelf, and been informed by others, for the Bags of ſalt I have uſually ſeen brought out of *Cheſhire* on Horſeback, contain 6 Buſhels and a half, or 7 Buſhels, whereas the beſt Horſes that carry ſalt from hence, if they carry it above 5 Miles, carry not above 3 Strike and 3 Pecks, or 4 Strike. A *Wincheſter Buſhel* of our Salt, weighs lf a hundred Weight, ſo that it muſt neceſſarily follow, the weightieſt d drieſt muſt needs be beſt.

3. In the time of the firſt *Dutch War*, our ſalt was carried down into the eſt, where they had none before but Foreign Salt, where at firſt uſing rs, they complained that it made their Meat too ſalt, which was becauſe ey put as much of ours on their Meat as of others: If ſo, it muſt be bet- than *French Salt*.

4. I have been aſſured by many that have made uſe both of ours, and *Cheſhire ſalt*, that both for Fleſh and white Meat they muſt lay on more of *Cheſhire ſalt* than of ours.

5. It doth preſerve all ſorts of Fleſh for long Voyages, viz. to *Jamaica*, as well as any, which hath been lately tried.

6. I have ſeen *Herrings* that have been ſalted with our Salt in *Ireland*, and brought over to this Town, which have been whiter and better taſted than thoſe ſalted with *Bay-ſalt*.

7. It is an ordinary Way of powdering Beef with us, to give it but one ſalting to keep it the whole Year.

We uſe not *Iron Pans* as they do in *Cheſhire*, and other places, for we have found upon Trials, that the *ſtrength* of the Brine doth ſo corrode, that it quickly wears out thoſe of forged Iron, and breaks thoſe of caſt Iron.

The Formation *of* Salt *and* Sand *from* Brine, by Dr. Rob. Plot. n. 145. p. 96.

XLVI. At my Requeſt two curious Obſervers, Neighbours to the Brine Pits in *Staffordſhire*, to 8 Folds of fine *Holland*, added as many more of finer *Cambrick*, through both which they ſtrained a competent quantity of the Brine, but found nothing left in this very cloſe Colander, but a little black Duſt, which they imputed only to the Foulneſs of the Water, it being nothing like Sand; for having examin'd the Cloth both with their Fingers and a Microſcope, they could feel or ſee no more of ſand, than if they had percolated the cleareſt Spring-water; and yet this Brine is found to hold in boiling at leaſt $\frac{1}{4}$ of as much ſand as ſalt.

But notwithſtanding this *Experiment*, it did not ſeem to their apprehenſions neceſſary that the ſand ſhould be generated in the boyling, but might rather be originally there; for before they ſtrained it, they obſerved in the Water, by the Help of a Microſcope, a great multitude of very minute Animals, much ſmaller than thoſe in *Pepper Water*, ſwimming about in it, together with many ſmall tranſparent Plates, ſome of them a little bigger than the Animalcules; and ſome leſs, but all of a Rectangular, Oblong Figure, tho' ſome indeed ſeemed very near a ſquare. which they found alſo in the Water after ſtraining as thick as before, the Pores or rather Interſtices between the Threads of the *Holland* and *Cambrick* appearing in the Microſcope 20 times greater than either the *Animalcules* or *Plates*. And theſe they judged to be the original Particles both of the ſalt and ſand, which as the Water evaporates in boyling, they thought might gather together till they made up ſuch a viſible courſe Body as we ſee the greater Corns of each are. Wherein they were confirmed in a little time, for obſerving with an excellent Microſcope, ſome of the ſtrong Brine which drops from the Baskets or Barrows, when the Salt is firſt put into them, though at firſt it looks like clear Water, yet upon a more accurate Obſervation, it appeared exceeding full of theſe oblong Particles, which as they look'd on them, they could ſenſibly perceive to gather together, and club to make greater parts, and as the Water dryed off from the Glaſs, to grow far larger and larger, till they appeared as big, and not much unlike a large ſiz'd Table Diamond: Which made them gueſs that the Sand might be alſo generated

Of

(if I may ſo ſay) after the ſame manner, it appearing to them to be nothing (pardon the Expreſſion) but inſipid Salt, compoſed of parts not ſo ſharp pointed as the other, but rounder and blunter angled, and conſequently not ſo pungent on the Tongue.

Upon this ſuggeſtion, having ſome of the *Sand* by me, I endeavour'd to diſſolve it in fair water, to ſee whether I could reduce it again into its former ſtate, but without ſucceſs; its parts being ſo inſeparably fixt, that they would by no means diſſolve. I alſo tried the *Salt*, which tho' it diſſolved, yet would not render it ſelf again into the Plates. Whereof ſending an Account to my Friends in *Staffordſhire*, they were pleaſed alſo to make a further Trial of diſſolving the *Sand* ſeparated from the *Salt* in boyling, which tho' they confeſs'd they could not do to any conſiderable Quantity, yet they found, that after the ſtraining, it was not ſo heavy by a great deal as before, the Water that came from it being very clear, which made them believe, that it did diſſolve in ſome meaſure, unleſs (as is very probable) there were in the *Sand* ſome Particles of *Salt*, which upon Diſſolution were ſeparated from it, and ſo rendred it lighter: Nevertheleſs they did not doubt, but a great part of the Sand might alſo be diſſolved, tho' perhaps no great quantity in *Pump water*, in which it ſeems they tried it.

One of the aforeſaid Gentlemen caſually looking upon ſome of the ſalt made at thoſe Pits before it was dried and beaten ſmall, obſerved that many of the larger Corns were of the ſame ſhape to the naked Eye as the minute ones appeared of in the Microſcope, and that they were viſibly made up of a great number of ſmall Plates, ſhooting up from a quadrangular oblong Baſe into a very obtuſe Pyramid, hollowed within.

XLVII. At *Northwich* in *Cheſhire*, upon the *Weever*, in 4 Pits is great Plenty of Brine; it ſtinks of *Sulphur* apparently in all the Pits; it becomes atramentous with Galls.

Obſervations on the Midland Salt ſprings *By Dr.* Liſter, n. 156. p. 489.

Here are uſed *Sand-pands*, which are let down in the corners of the great Iron Boilers, before the Salt ſhoots into Grains, and theſe catch the Sand. Beſides there are thick Stone Flakes raiſed from the bottom of the ſaid iron Boilers once a Week.

N. B. Within half a Mile of theſe *Brine-pits* at *Marberry*, a Salt Rock was found by the Augur in Boring for Coals.

vid. Inf. Cap. 3.

Here, and at *Middlewich*, alſo at *Nantwith*, and all along the River *Weever*, which are places many Miles diſtant, ſink on either ſide of the River, and you will ſcarce miſs of Brine, as I was credibly inform'd by the moſt knowing Men in that particular: But yet it proves a Venture whether the Brine will be ſtrong enough to boil and turn to account; and for this reaſon, their Pits ſometimes fail them, to their great Loſs, (as they ſhewed me one which had been wrought to very great Profit) by a ſmall ſweet Spring breaking into it, and ſometimes the River *Weever*, it ſelf does them this Miſchief.

At *Nantwich* upon the ſame River, is one very large Brine-pit. This Water alſo plainly ſmells as it were corrupted, or like Sulphur, but notoriouſly upon a few Days Forbearance of the Pit. It becomes atramentous with Galls. It yields a white Sand or Stone, adhering in the manner of thin Scales, to the Bottom of the iron Pans, in which the Brine is boiled.

Weſton Brine Pit near *Stafford*. This Water in the Pit ſtinks like rotten Eggs: With Galls it becomes ſuddenly atramentous. It purges and vomits violently, and that drunk in a ſmall Quantity. Here are uſed *Sand-pans* to catch the white Sand, and there are Flakes of Stone alſo, raiſed from the bottom of the great iron Boilers.

Droitwich in *Worceſterſhire*. The upper *Wych* or *Brine-pit* is very neatly kept, and exceedingly drawn, becauſe there are ſo many Proprietors, and but a ſmall Pit, comparatively to thoſe which have been named above.

Mr. J. Collins, S. & Fiſh.

Here the Salt is boiled in ſmall leaden Pans, and there is not the leaſt Grain of Sand at any time, which either falls before the graining of the Salt, or that adheres to the Pans Bottoms, notwithſtanding what hath been ſaid to the contrary: And therefore this Brine being naturally without Sand, it muſt yield the more wholeſome Salt.

The lower Pit at the *Netherwych* in the ſame Town, hath but one Proprietor, as I remember, and therefore is leſs drawn, but yet is conſtantly and well wrought. Here is alſo no News or Knowledge of any Sand at all. The Water of theſe Pits ſtinks like rotten Eggs, eſpecially after Sunday's reſt: And (*N. B.*) will, if Fleſh be pickled in them, make it ſtink in 12 Hours. And yet the Salt that is boiled out of theſe Pits, is accounted the very beſt Inland Salt of *England*, and I believe as good as any in the World.

I obſerved in a Ditch over againſt the *Nether Wych Houſes*, the water ſtanding with a white Scum, as at the *Sulphur-ſpaws* in *Yorkſhire*.

I ſhall add by way of Corollary,

1. That all our *Yorkſhire Wells* call'd *Sulphur Spaws*, (which are many) are no other than ſo many *Brine-pits*, and if they were well drawn and wrought, would be as little offenſive in Smell.

2. That this Stone-powder is alſo to be found adhering to the iron Pans, where the Sea-water is boiled into Salt, as it is at *Shields*, in the Biſhoprick of *Durham*; but I do not remember it to be in the Lead-pans at *Medop* and *Milthrop* in *Lancaſhire*, where the Sea-ſands are lixiviated, and that *Lixivium* boiled into Salt; nor is it remembred in the Account given of the making of *Sea-ſalt* by *Inſolation*: Nor could I obſerve it in the leaſt, in diſtilling of Sea-water in a Glaſs Still, or in the *Yorkſhire ſtinking Wells*; of which a good Quantity is yearly made for medical uſe, or rather Curioſity, to vend to Strangers.

Vid: Infr. §, XLVIII.

N. B. This *Sand* falls to the bottom before the ſalt Grains.

This is ſo alſo in all other *Mineral Salts*, whoſe Brines being boiled, ever let go firſt this ſtony part: The *Oker* falls in Powder upon the firſt boiling, but the *Lapis Calcarius* riſes in Flakes like Wafers, which yet falls in Powder by Froſt, as we have elſewhere obſerved.

3. This Stone-powder irrigated with fair Water, and kept moiſt, does yield an immature ſalt of an uncommon Figure: which I have deſcribed at large and figured.

De Foſt. Med. Angl.

4. Notwithſtanding the great Affinity betwixt the Salt of the Midland Brine-pits, which is common Salt, and the Sea-ſalt: I muſt not omit (amongſt others) a ſpecifick Difference, which is by me (that I know of) now firſt publiſhed, and which, in my Opinion, makes the Sea-water a Water of its own kind: And alſo ſhews, that none of the Productions of incinerated Plants are truly a *Marine-ſalt*.

The Angles of the Cryſtals of common Salt, boil'd out of the *Midland Brine-pits*; as alſo of ſalt Gem, or Rock-ſalt, which I take to be one and the ſame, are entire, and ſo are all thoſe lixiviated marine Salts, ſo called and deſcribed by Dr. *Grew*. But the *Angles* of the *Chryſtals* of true *Sea-ſalt*, are ever ſome of them cut off into *Triangular Planes*, at leaſt on one of the ſides. And this I learnt by ſuffering a bottle of *Sea-water*, taken up upon the Coaſt at *Scarborough*, where no River near enters it, to evaporate leiſurely placed in the ſhade, after it had been half boiled away; and here all the *Chryſtals* (which were many, and of different Magnitudes) did yet agree in a like Figure, as is deſcribed; and I do not doubt but it will ſucceed with any *Sea-water*.

The Way of making Salt in France, by Dr. . . . . n 51. p. 1425 *Fig.* 60.

XLVIII. *A A A*, is the *Sea*.

11. The Entry, by which the ſea-water paſſes into *B*, *B*.

B B. The firſt Receptacle; in which the Water is kept 20 *Inches* deep.

C C C. The 2*d* Receptacle, where the Water maketh 3 Turnings, as you ſee, and is 10 Inches deep.

22. The Opening, by which the firſt and 2d Receptacle have Communication one with another.

E E F. The 3d Receptable; which is properly call'd the *Mariſh*.

d d d d d d. Is a Channel very narrow, through which the Water muſt paſs, before it enters out of the 2d Receptacle into the 3d.

33. Is the Opening, by which the Water runs out of the 2d into the 3d Receptacle.

The *Pricks* you ſee in the Water throughout the whole ſcheme, do mark the Courſe and Turnings which the Water is forced to make before it comes to *h h h h h*, which are the places where the Salt is made.

h h h h h. Are the Beds of the *Mariſh*, where the *ſalt* is made; and in them the Water muſt not be above an Inch and an half deep. Each of theſe *Beds* is 15 Foot long, and 14 Foot large.

99999. Are the little Channels between the Beds.

88888, Are the Apertures by which the Beds receive the *Sea-water* after many Windings and Turnings.

When it rains, the *Openings* 22, 33, are ſtopp'd to hinder the Water from running into the *Mariſh*. Unleſs it rain much, the Rain-water doth little hurt to the *Mariſh*; the *Heat* of the *Sun* ſufficiently exhaling it, if it be not above an *Inch* high; only if it have rained very plentifully that day, no ſalt is drawn for the 3 or 4 next Days. But if it rain 5 or 6 days, the people are then neceſſitated to empty all the Water of the Beds by a peculiar Channel, which cannot be opened but when it is low Water. But 'tis very ſeldom that it rains ſo long as to conſtrain Men to empty thoſe Beds.

The hotteſt Years make the moſt Salt, and in the hotteſt part of the *Summer* there is ſalt made even during Night. Leſs *Salt* is made in calm, than in windy Weather.

The Weſt and North-weſt Winds are the beſt for this purpoſe.

Our Country People draw the ſalt every other day, and every time more than an hundred pound weight of ſalt.

The *Inſtruments* uſed to draw the Salt, have many ſmall Holes to let the Water paſs, and to retain nothing but the ſalt.

The reddiſh Earth in *Mariſhes* maketh the *Salt* more gray; the blewiſh, more white: Beſides, if you let run in a little more Water than you ought, the ſalt becomes then more white, but then it yields not ſo much. Generally all the *Mariſhes* require a fat Earth, neither ſpungy nor ſandy.

The *Salt-man* who draw the ſalt, muſt be very dextrous. In this *Iſle* of *Rhee* there are that draw very dark ſalt, and others that draw it as white as ſnow; and ſo it is in *Xaintonge*. Chiefly, Care is to be taken that the *Earth* at the bottom of the Beds mingle not with the ſalt.

The *Salt* we uſe at our Tables is perfectly white, being the *Cream* (or that ſalt which is formed on the Top of the Water) drawn 4 or 5 Hours before the ſalt is to be drawn. The Grains of it are ſmaller than of the other. Generally the ſalt of *Xaintonge* is ſomewhat whiter than ours. The Bigneſs of our ſalt is of the ſize of a Pepper Grain, and of a cubical ſhape.

The *Mariſhes* are preferred from one Year to another, by overflowing them a Foot high.

The Timber of the *Mariſhes*, if it be of good *Oak*, keeps near 30 *Years*, but there is uſed but little *wood*, all the *ditches* and *apertures* being done with *ſtones*.

In Lancaſhire, by Dr. J. Beale, n.103 p. 54. XLIX. At *Wire-water* in *Lancaſhire*, *ſalt* is gathered out of heaps of *ſand* along the ſea-ſide in many places: Upon which ſand (ſaith *Speed*) the People pour Water, until it gets a ſaltiſh Humour, which they afterwards boil with Turfs, till it become white ſalt.

The Water of the Brine-pits in Summer-time, when the Brine is ſtrongeſt, being caſt in any place where it may be ſoon dried by the *ſun*, and where we would have *Pigeons* reſort, does pleaſe them well; ſo will any refuſe Brine being boiled up to a Conſiſtence. But I know not whether ſuch Brine, taken from powder'd Fleſh, will be kind for Sheep.

In Germany, by . . . n. 7. p. 128. L. An obſerving Gentleman writes out of *Germany*, That no *ſalt Water* which contains any *Metal* with it, can well be ſodden to ſalt in a Veſſel of the ſame Metal which it ſelf contains, except *Vitriol* in *Copper Veſſels*.

He adds, that to ſeparate ſalt from ſalt-water without Fire, if you take a Veſſel of *Wax*, hollow within and every where tight, and plunge it into the *Sea*, or into other *ſalt Water*, there will be made ſuch a ſeparation, that the Veſſel ſhall be full of ſweet Water, the ſalt ſtaying behind; but though this Water have no ſaltiſh Taſte, yet he ſaith, there will be found a *ſalt* in the Eſſay, which is the *Spirit* of *Salt*, ſubtile enough with the Water to Penetrate the Wax.

LI. We have ſeen here (at *Leyden*) a Maid, of about 13 Years of age, which from the time that ſhe was but 6 Years Old, and began to be about her Mother in the Kitchen, would, as often as ſhe was bid to bring her Salt or could elſe come at it, fill her Pockets therewith, and *Eat* it, as other Children do Sugar; whence ſhe was ſo dried up, and Grown ſo Stiff, that ſhe could not Stir her Limbs, and was thereby Starved to Death. *The Joynts of a Girl made Stiff by Eating Salt*, By . . . . n. 8. p. 138.

LII. *Papers of Leſs General Uſe*, Omitted.

1. Some Objections of the *Fr. Journaliſt* to the *Engines* for *Drawing up Water from the Bottom of the Sea*, and for *Sounding the greateſt Depths without a Line*, Anſwer'd by a Mr *Oldenburg*. n.33.p.228.

2. Inquiries concerning the *Sea*; by Mr. *Rob. Boyle*. n.18.p.315.

3. Inquiries and Directions concerning *Tides*; propoſed by Dr. *J. Wallis*. n.17.p.297.

4. Patterns of *Tables* propoſed to be made for obſerving of *Tides*, by Sir *Rob. Moray*. n.18.p.311.

5. Quæries about *Tides* in *China* and the *E. Indies*; by Mr. *Edm. Halley*. n.162.p.689

6. Several Engagements for *Obſerving* of *Tides*. n.21.p 378.

7. A Correct *Tide-Table*, ſhewing the True Time of *High Water* at *London Bridge* to every day in the *Year* 1682; by Mr. *Flamſteed*. *Phil.Coll.*n.4. p. 102.

8. The ſame, for the Year 1683. n.143.p.10.

9. The ſame, for the *Year* 1684. n.153.p.458

10. The ſame, for the *Year* 1685. n.166.p.822

11. The ſame, for the *Year* 1686. n. 177. p. 1216.

12. The ſame, for the *Year* 1687. n.185.p.252

13. The ſame, for the *Year* 1688. n.191.p.428

14. Objections from *Voſſius*, De *Motu Marium & Ventorum*, and from *Gaſſendus*, *De Æſtu Maris*, to Dr. *Wallis's Theory* of *Tides*, Anſwer'd; by Dr. *Wallis*. n.16.p.286.

15. Quæries and Conjectures concerning *Mineral Waters*; by Dr. *Dan. Foot*. n.52.p.1054

16. An Inquiry concerning the *Cauſes* of *Mineral Springs* propoſed; by Dr. *J. Beal*. n.58.p.1131

17. Some Quæries whereby to Examine *Mineral Waters*; by Sir *Will. Petty*. n 166.p 802

18. Inquiries about the *Salt-Springs* in *Worceſterſhire* and *Cheſhire*; by Dr. *J. Beal*. n.20 p.359.

19. Inquiries and Suggeſtions concerning Salt for *Domeſtick Uſes*; by Dr. *J. Beal*. n.1[illegible]

LIII. *Accounts, Refutations, and Emendations, of Books*, Omitted.

1. *Iſ. Voſſius* de *Motu Marium & Venterum*. n.16.p 286.

2. *Gaſſendus* de *Æſtu Maris*. ib. p. 287.

3. De

n.167.p.862 3. De Origine *Fontium* Tentamen Philoſophicum, in Prælectione habita coram *Societate Philoſophica* nuper *Oxoniæ* inſtituta ad *Scientiam Naturalem* promovendam. Per *Rob. Plot.* L. L. D. *Oxon.* 1685. in 8°.

n.233.p.734 4. De *Fontium Mutinenſium* admiranda Scaturigine, Tractatus Phyſico-Hydroſtaticus *Bernardini Rammazzini*, in *Mutinenſi* Lycæo Med. Prof. *Mutinæ.* 1691 in 4°. Tranſlated into *Engliſh*, and illuſtrated with many curious Remarks and Experiments by the Auth. and Tranſlator, Dr. *Rob.* St. *Clair. Lond.* 1697. in 8°.

n.51.p.1038 5. Dr. *Tobias Whitaker* of Drinking *Mineral Waters*, 1634.

n.42.p.850. 6. *Hydrologia Chymica*, or the Chymical Anatomy of the *Scarbrough* and other *Spaws* in *Yorkſhire*, *&c.* by *W. Sympſon. Lond.* 1668. in 8°.

n.49 p.599. 7. An Anſwer to *Hydrologia Chymica* of *Will. Sympſon*; by *Rob. Wittie.*
n.51.p.1038 M. D. *Lond.* 1669. in 8°. *Beſides the* Account *of this* Book, *there is a Correction of a* Miſtake *of the Printer in the* 3*d* Page.

n.52.p.1050 *Some Reflections made on this Accompt of Dr.* Wittie's *Anſwer to* Hydrologia Chymica; *by Dr.* Dan. Foot.

n.57.p.1154 *Dr.* Foot's *Reflections conſider'd*; *by Dr.* J. Beal.

n.56 p.1118 *Some Conſiderations relating to Dr.* Wittie's Defence of Scarborough Spaw; *by Dr.* Highmore.

n.60.p.1074 *A Diſcourſe of Dr.* Rob. Wittie, *relating to the Notes and Quaries of Dr.* Foot, *and to thoſe of Dr.* Highmore, *concerning* Mineral Waters, *and* Extracts *made out of them.*

p.62.p.2038 8. A Vindication of *Hydrologia Chymica*, by *Will. Sympſon.* M. D. *Lond.* 1670.

[illegible] p.5019 9. *Scarborough Spaw* ſpagyrically Anatomiz'd. *An.* 1670; and a *New Years Gift* for Dr. *Wittie. Lond.* 1671. both in 12°. *by Geo. Toſtal.* M. D.

n.144.p.59. 10. 1. *M. Liſter* M. D. *De Fontibus Medicatis Angliæ*; Exercitatio nova & Prior. *Eboraci* 1682. in 8°.

n.158.p.579 2. M. *Liſter.* M. D. *De Fontibus Medicatis Angliæ*; Exercitatio Altera *Lond.* 1684. in 8°.

n. 172. p.1063. 11. Short *Memoires* for the *Natural Experimental Hiſtory* of *Mineral Waters*, by the Honourable *Rob. Boyle*, *Lond.* 1685. in 8°.

n. 206. p. 1003. 12. Tentamen Philoſophicum de *Aquis Mineralibus*, *&c.* Auth. *Carolo Leigh.* M. D. *Lond.* 1694 in 8°. *Dr.* Cay *here Objects many things to that* Author's *Obſervations.*

n.245.p.368
n.251.p.146 13. The *Natural Hiſtory* of the *Chalybeat* and *Purging Waters* of *England*, with their particular Eſſays and Uſes, *&c.* with Obſervations on the *Bath Waters* in *Somerſetſhire*, by *Benj. Allen.* M. D. *Lond.* 1699.

n.225.p.612 14. Obſervations ſur les *Eaux Minerales* des pluſieurs Provinces de *France*, faites en *l'Academie Royale* des *Sciences*, *en l'Anne* 1670. *&* 1671. par le Sieur *du Clos.* A *Paris.* 1675. in 12°.

n.125.p.573 15. *Bathonienſium* & *Aquiſgranenſium Thermarum* Comparatio, variis adjunctis illuſtrata, a *R. P. Lond.* 1676. in 8°.

CHAP.

CHAP. III.

Mineralogy.

I. 1. THE *Mine* or *Adit* is to be made 7 or 8 foot high, which though it ſeem to make more work downwards, yet will be found neceſſary for making the better Diſpatch by rendring the *Invention* more effectual.

There is a Tool of Iron well Steeled at the end, which cuts the Rock, (of the Shape ſhewed by the *Figure* annexed) 20 or 22 Inches long, or more, and ſome 2½ Inches Diameter at the Steeled end, the reſt being ſomewhat more ſlender. The Steeled end is ſo ſhaped, as makes it moſt apt to Pierce the Rock, the Angles at that end being ſtill to be made the more Obtuſe, the Harder the Rock is. This Tool is to be firſt held by the hand in the middle between the Sides of the Rock that is to be cut, but as near the bottom as may be. The Tool being placed, is to be ſtruck upon with a Hammer, the heavier the better, either ſuſpended by a Shaft turning upon a Pin, or otherwiſe, ſo ſoon as one Man may manage the Hammer while another holds the Tool or *Piercer.* If it be hung in a Frame, or other convenient way he that manageth it hath no more to do but to pull it up at firſt as high as he can, and let it fall again by its own Weight, the Motion being ſo directed as to be ſure to hit the Piercer right. After the ſtroke of the Hammer, he that holds the Piercer, is to turn it a little on its point, ſo that the Edges or Angles at the Point may all ſtrike upon a new Place, and ſo it muſt ſtill be ſhifted after every Stroke, by which means ſmall Chipps will at every ſtroke be broken off, which muſt from time to time be taken out, as need requires. And thus the Work muſt be continued, till the Hole be 18 or 20 Inches deep, the deeper the better. This Hole being made deep as is required, and kept as ſtraight and ſmooth in the ſides as is poſſible, there is then a kind of Double Wedge to be made, and fitted exactly for it, the ſhape whereof is to be ſeen in the annexed Figure.

To Break hard Rocks; by M. De Som. n. 5. p. 82.

Fig. 67.

This Double Wedge being 12 or 13 Inches long, each piece of it, and ſo made as being placed, in their due Poſition, they may make up a *Cylinder,* cut *Diagonal wiſe.* The 2 Flat-ſides that are Contiguous, are to be Greaſed or Oiled, that the one may ſlip the more eaſily upon the other; and one of them, which is to be uppermoſt, having at the Great end a Hollow Creaſe cut into it round about, for faſtning a Cartridge Full of *Gun-powder* to it with a thread, the Round End of the Wedge being pared as much as the thickneſs of the Paper or Paſt board that holds the *Powder* needs, to make the outſide thereof even with the reſt of the Wedge. This Wedge muſt have a Hole Drilled through the longeſt ſide of it, to be filled with *Priming Powder,* for firing of the *Powder* in the *Cartridge*: Which needs have no more than half a Pound of *Powder,* though upon occaſion a greater quantity may be uſed, as ſhall be found Requiſite.

Fig. 68.

Then this Wedge, being firſt thruſt into the Hole with the *Cartridge,* the Round ſide, where the Priming Hole is, being uppermoſt, the other Wedge is to be Thruſt in, home to the due Poſition, care being taken that they fit the Hole in the Rock as exactly as may be. Then the End of the lower Wedge being about an Inch longer than that of the upper, outwardly and Flatten'd, *Priming Powder* is to be laid upon it, and a piece of burning *Match*, or Thred dipt in Brimſtone, or other ſuch prepared Combuſtible matter, faſtned to it, that may burn ſo long before it Fire the *Powder* as he that orders it may have time enough to retire quite out of the Pit or *Adit*, having firſt placed a piece of Wood or Iron ſo, as one end thereof being ſet againſt the end of the Lower Wedge, and the other againſt the Side Wall, ſo as it cannot Slip. Which being done and the Man retired, when the *Powder* comes to take Fire, it will firſt drive out the Uppermoſt Wedge as far as it will go; but the flaunting Figure of it being ſo made, as the Farther it goes backward the Thicker it grows, till at laſt it can go no farther, then the Fire Tears the Rock to get forth, and ſo Cracks and Breaks it all about, that at one time a vaſt deal of it will either be quite Blown out, or ſo crak'd and broken as will make it eaſie to be Removed.

By Mr. Beaumont. n. 167. p. 854. 2. A conſiderable *Adventurer* in the *Lead Mines* on *Mendipp-Hills* acquaints me that the *Miners* there, within theſe 12 Months, had got a new way of *Cleaving Rocks* with *Gunpowder*.

Fig. 69. The *Borier* is made of Iron, and is 2 Foot 2 Inches in length: It is an Inch ſquare at the Steeled end from *a* to *b*, and ſomewhat leſs in the other part. The uſe of this Inſtrument is to make a Hole in the Rock deep enough to receiver the *Powder*. The Gun is 6 Inches in length, 1¼ Diameter, and has a Hole drilled through it to receive the *Priming Powder*. When a Hole is *Fig.* 70. made with the *Borier* ſomewhat deeper than the length of the *Gun*, they Dry it with a Rag, and put into it about 2 or 3 Ounces of *Powder*, over which they put a thin Paper, and on it place the Gun which they bind firmly into the Hole, by driving in againſt the Flat ſide of the Upper part of it a little Iron Wedge 4 Inches in length, by the *Miners* called a *Quinnet*.

Fig. 71. When this is done, they paſs down a Wire through the Hole drilled in the Gun, and pierce the Paper which covers the *Powder*, and then they *Prime* the Gun, and lay a *Train*, and go up out of the work before the *Powder* comes to take Fire. The *Paper* is put at firſt over the *Powder*, leſt when the Gun and *Quinnet* are driven down, the Tools may Strike Fire and Kindle the *Powder*.

Theſe *Inſtruments* are of great Advantage to *Miners*; for as ſoon as a Man has Fired his *Powder* and broken the Rock, he may preſently go to Work again, whereas after a Fire is laid in a Shaft, a Man can ſcarce go to work in 24 Hours; the Rocks being too Hot to ſuffer him.

Okey-Hole, *and ſome other* Subterraneous Caverns *in* Mendipp Hill; *by* Mr. J. Beaumont. *Ph. Col. n. 2. p. 1.* II. 1. On the South ſide of *Mendipp-Hills* within a Mile of *Wells* is a Famous *Grotto* known by the Name of *Okey-Hole*, much reſorted to by Travellours: The entrance of it is in the fall of thoſe Hills, which is there all beſet with Rocks, having near it a Precipitous Deſcent about 10 or 12 Fathom deep; at the Bottom of which there always iſſues from the Rocks a conſiderable Current of Waters. The naked Rocks above the entrance, ſhew themſelves for about 30 Fathom in height; though the whole Aſcent of the Hill above it, is about a Mile, and is very Steep.

As you paſs into this *Vault* you go upon a Level, but advancing further into it, you find the Way Rockey and uneven, ſometimes Aſcending, and ſometimes Deſcending, as generally in all Caverns. The Roof of it, in the higheſt part, is about 8 Fathom from the Floor, and in ſome places it is ſo low that a Man muſt ſtoop to paſs. The Wideneſs of it is alſo various; in ſome parts it is about 5 or 6 Fathom, in others not above a Fathom or two, It extends it ſelf in Length about 200 Yards. People talk much of ſeveral Stones there reſembling Men and other Things, but they are only Lumps of Common *Spar* without any *Regular Figures*.

At the fartheſt part of this *Cavern* there riſes a good Stream of *Water*, large enough to drive a Mill, which paſſes all along one ſide of the *Cavern*, and at length glides down about 6 or 8 Fathom betwixt the Rocks, and then preſſing through the Clefts of them, diſcharges it ſelf into a Valley.

This *River* within the *Cavern*, is well ſtor'd with *Eels*, and hath ſome *Trouts* in it, which muſt of neceſſity have been *Engendred* there, and not come from without, there being ſo great a Fall as I have mention'd near the Entrance. It happen'd ſome few Years ſince, that many Cattle which fed in Paſtures through which this River paſſes, died ſuddenly after a Flood, the Cauſe of it being ſuppoſed to be, that theſe Waters had a Communication under Ground in *Mendipp-Hills*, with certain Waters which came from the Waſhing of *Lead Ore* in the *Minery Ponds*, which are two Miles and an half diſtant from this *Cavern*, and were conveyed into the Ground by a *Swallow*, near the place where the *Ore* was waſht; which *Swallow*, has ſince been cauſed to be damm'd up.

In a dry Summer, I have ſeen a good number of *Frogs* all along this *Cavern*, even to the fartheſt part of it, and other little *Animals* in ſome ſmall *Ciſterns* of *Water* there.

Before you come to the middle of this *Vault*, you will find a Bed of very fine Sand, which is much ſent for by Artiſts to Caſt *Metals* in.

On the Roof of it, at certain places, hang Multitudes of *Batts*. And indeed we generally find them in all *Caverns*, whoſe Entrance is upon a Level, or ſomewhat Aſcending or Deſcending, ſo it be not perpendicularly; and even in theſe, if the Paſſage into them be not narrow, and of a conſiderable height or depth.

2. About 5 Miles from this, on the South-weſt part of *Mendipp-Hills*, near a place call'd *Chedder*, lies another *Cavern*, into which you muſt aſcend about 15 Fathoms on the Rocks. This *Cavern* is not of ſo large Extent as the former; there is no Current of Water, nor does Water drop ſo freely from the Roof as generally in other *Caverns*, wherefore the *Spars* appear not of ſo lively Colours as commonly elſewhere.

3. Theſe two *Caverns* have no Communication with *Mines*: But we generally obſerve, that whereſoever *Mines* of *Lead Ore* are, there are *Caverns* belonging to them, which are of a various Nature and Situation. The moſt Conſiderable of theſe *Vaults* I have known on *Mendipp Hills*, is on the moſt Northerly part of them, in a Hill call'd *Lamb*, lying above the Pariſh of *Harptry*. Much *Ore* has been formerly raiſed on this Hill; and being told

ſome Years ſince that a very great *Vault* was there diſcover'd, I took 6 *Miners* with me, and went to ſee it. Firſt we Deſcended a perpendicular *Shaft* about 10 Fathom, then we came into a *Leading Vault*, which extends it ſelf in Length about 40 Fathom; it runs not upon a Level but Deſcending, ſo that when you come to the End of it, you are 23 Fathom deep, by a Perpendicular Line. The Floor of it is full of looſe Rocks; its Roof is firmly *Vaulted* with Lime-ſtone Rocks, having Flowers of all Colours hanging from them, which preſent a moſt Beautiful Object to the Eye, being always kept moiſt by the diſtilling Waters. In ſome parts the Roof is about 5 Fathom in height, in others ſo low, that a Man has much ado to paſs by Creeping. The Wideneſs of it, for the moſt part, is about 3 Fathoms. This *Cavern* croſſes many *Veins* of *Ore* in its running, and much *Ore* has been thence raiſed. About the Middle of this *Cavern*, on the Eaſt ſide, lies a narrow Paſſage into another *Cavern*, which runs betwixt 40 and 50 Fathom in length. At the end of the *Firſt Cavern* a *Vaſt Caverns* opens it ſelf. I faſtened a Cord about me, and ordered the *Miners* to let me down: And upon the Deſcent of 12 or 14 Fathom I came to the Bottom. This *Cavern* is about 60 Fathom in the *Circumference*, above 20 Fathom in height, and about 15 in length; it runs along after the *Rakes*, and not *Croſſing* them as the leading *Vaults* does. I afterwards cauſed *Miners* to drive forward in the Breaſt of this *Cavern*, which terminates it to the Weſt, and after they had driven about 10 Fathom, they happened into another *Cavern*, whoſe Roof is about 8 Fathom, and in ſome parts 10 or 12 in height, and runs in Length about 100 Fathom.

Vid. Inf. 3.

The frequency of theſe Caverns on thoſe Hills may be eaſily gueſt at, by the frequency of *Swallow Pits* which occur there in all Parts, and are made by the falling in of the Roofs of Caverns; ſome of theſe Pits being of a large Extent and very deep; and ſometimes our *Miners* ſinking in the Bottom of thoſe Swallows, having found *Oaks* 15 Fathom deep in the Earth.

Elden-Hole in Darbyſhire; *By* Dr. Plot, ib. p. 7 Ph. Col. n. 2. p. 7.

III. Dr. *Plot* has learnt by an Inquiſitive Gentleman, who purpoſely made Tryal of it, that one of thoſe Caverns in the *Peak* in *Darbyſhire*, hath been ſounded in depth by a Perpendicular Plum Line, no leſs than *Eight and Twenty Hundred* Feet, without meeting with the Bottom, or Water; and yet the Mouth of this Cavern at the Top is not above 40 Yards over.

Pen-Park-Hole in Glouceſterſhire; *By Capt.* Sturmy, n. 143. p. 2.

IV. 1. Upon the 2d of *July* 1699. I deſcended by Ropes affixt at the top of an Old *Lead Ore-Pit*, 4 Fathoms almoſt Perpendicular, and from thence 3 Fathoms more Obliquely, between two great Rocks, where I found the Mouth of this ſpacious Place, from which a *Mine-Man* and my ſelf lowred our ſelves by Ropes 25 Fathoms Perpendicular, into a very large Place, which reſembled to us the form of a Horſe-ſhoe; for we ſtuck lighted Candles all the way we went, to diſcover what we could find remarkable. At length we came to a River or great Water, which I found to be 20 Fathoms broad, and 8 Fathoms deep. The *Mine-Man* would have perſwaded me, that this River Ebbed and Flowed, for that ſome 10 Fathoms above the place we now were in, we found the Water had ſometimes been: But I proved the contrary, by ſtaying there from 3 Hours *Flood* to 2 hours *Ebb*; in which time we found no alteration of this River. Beſides, its Waters are Freſh, Sweet and Cool, and the Surface of this Water as it is now at 8 Fathom deep, lies lower than the bottom of any part of the *Severn-Sea* near us, ſo that it can have no community with it. As we were walking by this River 32 Fathoms under the Ground, we diſcovered a great Hollowneſs in a Rock ſome 3 Foot above us; ſo that I got a Ladder down to us, and the *Mine-man* went up the Ladder to that Place, and walk'd into it about 70 Paces, till he juſt loſt a ſight of me, and from thence chearfully call'd unto me, and told me he had found what he look'd for, a *Rich Mine*. But his Joy was preſently turn'd into Amazement, and he return'd affrighted by the ſight of an *Evil Spirit*, which we cannot perſwade him but he ſaw, and for that Reaſon will go thither no more.

Here are abundance of ſtrange Places; the Flooring being a kind of white Stone Enamel'd with *Lead Ore*, and the Pendant Rocks were glazed with *Salt Peter*, which Diſtilled upon them from above, and time had Petrefy'd.

By Sir Rob. Southwell. ib.

Four Days together after his return, Capt. *Sturmy* was troubled with an unuſal and violent Head Ach, which he imputed to his being in that Vault; and falling from his Head-Ach into a Fever, he ſoon after dyed.

By Captain Collins. ib. p. 4.

Fig. 1. 72, 73

2. 'Tis down the *Tunnel*, *CC*, from the *Superficies* of the *Earth A A*, to the opening of the *Cavity* below, 39 Yards; Then the *Hole E E*, ſpreading into an irregular Oblong Figure, is in the greateſt length 75 Yards, and in the greateſt breadth 41 Yards. From the higheſt part of the Roof to the Water was then 19 Yards. The Water *HH*, was now in a Pool at the North End, being the deepeſt part; it was in length 27 Yards, in breadth 12, and only five Yards and an half deep. Two Rocks *G G*, and *L L* appeared above the Water all covered with *Mud*: But the Water was ſweet and good. There was a large Circle of *Mud*, *K K K*, round the Pool, and far up towards the South End, which ſhew'd that the Water has at other times been 6 Yards higher than at this preſent.

Sep. 18, and 19, 1682. The *Tunnel* or Paſſage down, was ſomewhat Oblique, very Ragged and Rocky; in ſome places it was two Yards wide, and in ſome three or four; but nothing obſervable therein, ſave here and there ſome of that *Sparr* which uſually attends the *Mines* of *Lead Ore*. In the Way 30 Yards down, there runs in Southward a Paſſage *D D*, of 29 Yards in length, parallel to the *Superficies* above; it was two or three Yards high, and commonly as Broad, and alike Rocky as the *Tunnel*, with ſome appearances of *Sparr*, but nothing elſe in it except a few *Bats*.

The *Cavity* below was in like manner Rocky and very Irregular; the Candles and Torches burnt clear, ſo as to diſcover the whole extent thereof; nor was the Air any thing offenſive.

The Bottom of this Hole *I*, where the *Land Waters* do gather, is 59 Yards down from the *Superficies* of the Earth; and by good *Calculation* the ſame bottom is Twenty Yards above the higheſt Riſing of the *Severn*, and lies into the Land about three Miles diſtant from it, and about as far from *Briſtol*.

Air in Mines; By Mr. J. Gill, n 26. p. 481.

V. One *John Gill* Aſſirms, from 20 Years Experience of his own, that if in digging deep under Ground, the Workmen meet with Water, they never want *Air* or *Wind*; but if they miſs Water (as ſometimes it happens, even at 12 or 16 Fathoms deep) they are diſtitute of convenient Air, either to Breath in, or to make their Candles Burn; and that when they drive up an *Adit*, for drawing away a great Quantity of a Winter's ſtanding Water from a deep Mine, as ſoon as it is brought up ſo near, that any of the ſtanding Water begins to run away, the Men muſt ſecure themſelves as well as they can, from Danger of being daſhed in pieces againſt the ſides of the *Adit*: For the included Air or Wind, in the ſtanding Water, breaks forth with ſuch a terrible Noiſe, as that of a piece of *Ordnance*, and with that violence, as to carry all before it, looſening the very Rocks, though at ſome Diſtance in the Work or *Adit*.

To Work in Mines without Air-ſhafts; By Sir Rob. Moray, No. 5, p. 79.

VI. At the Mouth or Entry of the *Adit* (to the *Coal Mines* of *Liege*) there is a ſtructure raiſed of Brick like a Chimney, ſome 28 or 30 Foot high in all; at the bottom, two oppoſite ſides are, or may be, ſome 5½ foot broad, and the other two 5 Foot; the Wall 1½ Brick thick. At the lower part of it is a Hole, ſome 9 or 10 Inches ſquare, for taking out of the *Aſhes*, which when it is done, this *Aſh Hole* is immediately ſtopt ſo cloſe, as Air cannot poſſibly get in at any part of it. Then ſome 3 Foot above Ground, or more, there is on that ſide, that is next to the *Adit*, or Pit a ſquare Hole of 8 or 9 Inches every way, by which the Air enters to make the Fire burn: Into this Hole there is fixt a ſquare *Tub* or *Pipe* of Wood, whereof the Joints and Chinks are ſo ſtopped with Parchment paſted or glewed upon them, that the Air can no where get into the *Pipe* but at the End; and this *Pipe* is ſtill lengthened as the *Adit* or Pit advanceth, by fitting New *Pipes* ſo, as one end is always thruſt into the other, and the Joints or Chinks ſtill carefully cemented, and ſtopt as before. So the *Pipe* or *Tube* being ſtill carried on, as near as is neceſſary to the Wall or place where freſh Air is requiſite, while the Air is drawn by the Fire from thence through the *Tube*, freſh Air muſt needs come in from without, to ſupply the place of the other; which by its Motion doth carry away with it all the ill Vapours that Breath out of the Ground: By which means the whole *Adit* will be always fill'd with freſh Air, ſo that Men will there Breath, as ſurely as abroad, and not only Candles burn, but Fire, when upon occaſion there is uſe for it for breaking of the Rock.

There muſt be Two of the Iron Grates, that when any Accident befalls the one the other may be ready to be in its place; the *Coals* being firſt well kindled in it: But when the Fire is near ſpent, the Grate being haled up to the Door, is to be ſupplyed with freſh Fewel.

The higher the Shaft of the Chimney is, the Fire draws the Air the better. And this Invention may be made uſe of in the Pits or Shafts that are Perpendicular, or any ways inclining towards it, when there is want of freſh Air at the bottom thereof; or any Moleſtation by Unwholſome Fumes or Vapours.

The whole Contrivance of the Fabrick, may be eaſily underſtood by the annexed Figure. *Fig.* 74.

A. The *Hole* for taking out the *Aſhes*. *B*, the ſquare Hole into which the *Tube*, or *Pipe*, for conveying the *Air*, is to be fitted. *C.* The Border or Ledge of *Brick* or *Iron*, upon which the *Iron Grate* or *Cradle*, that holds the burning Coals, is to reſt; the one being exactly fitted for the other. *D*, The *Hole* where the Cradle is ſet. *E*, The wooden *Tube*, thro' which the *Air* is conveyed towards the *Cradle*. *F*, The *Door*, by which the Grate or *Cradle* is let in, which is to be ſet 8 or 10 Foot higher than the Hole *D*; and the Shutter made of Iron, or Wood that will not ſhrink, that it may ſhut very cloſe. *G*, the *Grate* or *Cradle* which is narrower below than above, that the *Aſhes* may the more eaſily fall, and the *Air* excite the Fire, the Bottom and ſides being barred. *H*, The *Border* or *Ledge* of the *Cradle*, that reſt upon Ledge *C*, *I*, Four *Chains* of *Iron* faſtened to the 4 Corners of the *Cradle*, for taking it up and letting it down. *K*, The *Chain* or *Iron* to which the other *Chains* are faſten'd. *L*, the Pulley of Iron or Braſs through which the *Chain* paſſeth. *M*, A *Hook* on which the *Chain* is faſten'd by a Ring; the *Hook* being fixed at the ſide of the *Door*. *N*, A Bar of Iron in the Walls to which the Pully is faſten'd.

Damps in Mines, by Sir Rob. Moray, n. 3. p. 44.

VII. 1. In a *Coal-pit* belonging to the Lord *Sinclair* in *Scotland*, where the *Coal* is ſome 18 or 20 foot thick, and anciently waſted to a great depth: The *Colliers* ſome Weeks ago, having wrought as deep as they could, and being to remove into new Rooms, as they call them, did, by taking off, as they retired, part of the *Coal* that was left as Pillars, to ſupport the *Roof* and *Earth* over it, ſo much weaken them, that within a ſhort ſpace after they were gone out of the *Pit*, the *Pillars* falling, the *Earth* above them filled up the whole ſpace, where the *Colliers* had lately wrought, with its Ruins. The *Colliers* being hereby out of Work, ſome of them adventur'd to work upon old remains of Walls ſo near the old Waſtes, that ſtriking thro' the ſlender partition of the *Coal-wall*, that ſeparated between them and the place where they uſed to work, they quickly perceived their Error, and fearing to be ſtifled by the bad Air, that they knew poſſeſſed theſe old Waſtes, in Regard not only of the *Damps* which ſuch *Waſtes* do uſually afford, but becauſe there had been for many years a *Fire* in thoſe *Waſtes* that filled them with ſtifling Fumes and Vapours, retired immediately, and ſaved themſelves from the *Eruptions* of the *Damp*: But next day ſome 7 or 8 of them came no ſooner ſo far down the Stairs that led them to the place where they had been the Day before, as they intended, but upon their ſtepping into the place where the Air was infected, they fell down dead as if they had been ſhot: And there being amongſt them one, whoſe Wife being informed he was ſtifled in that place, ſhe went down ſo far without inconvenience, that ſeeing her Husband near her, ſhe ventured to go to him, but being choaked by the Damp, as ſoon as ſhe came near him, ſhe fell down dead by him.

By Dr. Edw. Brown, n. 48. p. 965.

2. *Damps* happen in moſt of the *Hungarian Mines*, not only in the *Cuniculi*, or *direct Paſſages*, where they walk on *Horizontally* (by thoſe *Mine-men* called

Stollen) but alſo in the *Putei* or perpendicular Cuts or Deſcents, termed *Schachts* by the ſame. They are met with not only in Places where the Earth is full of *Clay* or the like ſubſtances, but alſo where it is rocky, and one Place they ſhewed me in the Copper-mine at *Hern Groundt*, where there had been a very pernicious Damp, and yet the Rock ſo hard, that it could not be broken by their Inſtruments, but the Deſcent was all made by the means of Gun-powder, ramm'd into long round Holes in the Rock, and ſo blown up. Another place they ſhewed me, where there is ſometimes a Damp, and ſometimes Clear Weather. When there is much Water in the *Mine*, ſo as to ſtop up the lower part of this Paſſage, then this Damp becomes diſcoverable, and commonly ſtrong. I procured one to enter it, till his Lamp went out 4 or 5 times, in the ſame Manner as at *Grotto del Cane* in *Italy*.

Some of theſe Damps ſuffocate in a ſhort ſpace of Time, others only render the Workmen faint, with no farther Hurt, except they continue long in the place. The *Miners*, who think themſelves no Workmen, if they be not able to cure a Damp, or to cure the bad Weather, or make the Weather, as they term it, perform it by Perflation, by letting the Air in and out, and cauſing as 'twere a Circulation of it. In the Mine at *Hern Groundt* they did cure a bad Damp by a great pair of Bellows, which were blown continually for many days. The ordinary Remedy is by long Tubes, thro' which the Air continually paſſing, they are able to dig ſtraight on for a long way, without Impediment in Breathing: For ſome *Cuniculi* are 500 Fathom long, which will not ſeem ſtrange to any one that ſhall ſee the Map of the *Copper-mine* at *Hern Groundt*, or the *Gold-mine* at *Chremnitz*: And in the *Silver Trinity-mine* by *Schemnitz*, I paſſed quite under a Hill, and came out on the other ſide. At *Windſchachmine* by *Schemnitz*, they ſhewed me the place where 5 Men and a Gentleman of Quality were loſt: For which reaſon they have now placed a Tube there. The like they place over all *Doors*, and over all *Ways*, where they dig right on for a great ſpace, and have no Paſſage thro'. At *Chremnitz* they told me, that 28 Men had been killed at one Time in 4 *Cuniculi*, 7 in each; and in the ſinking of *Leopold*'s Pit, which is 150 Fathoms deep, they were much troubled with Damps, which they remedied in this Manner:

They fix'd a Tube to the ſide of the *Schacht* or Pit, from the Top to the Bottom: And that not proving ſufficient, they forced down a broad flat Board, which covered or ſtopped the Pit, or couched very near the ſides of it on all ſides but where the Tube was, and ſo forced out all the Air in the Pit through the Tube, which Work they were forced often to repeat. And now they have divers other Paſſages into it, the Air is good and ſufficient, and I was drawn up through it without the leaſt Trouble in Breathing.

But beſides this Miſchief from poyſonous Exhalations, Stagnation of the Air or Water, impregnated with mineral Spirits, they ſometimes periſh by other ways. For there being in theſe Mines an incredible Maſs of Wood to ſupport the Pits, and the Horizontal Paſſages, (the *Putei* and *Cuniculi*) in all places but where it is rocky, Men are ſometimes deſtroyed by the Wood ſet on Fire. And in the Gold Mine at *Chremnitz* the Wood was ſet once on Fire by the Careleſneſs of a Boy, and 50 Miners ſmothered thereby; who were all taken out but one, that was afterwards found to be diſſolved by the *Vitriol Water*, nothing eſcaping either of Fleſh or Bones, but only ſome of his Cloaths.

3. There are 4 ſorts of *Damps*. The firſt is the *ordinary* ſort. The external Signs of its Approach are the *Candles* burning *Orbicular*, and the *Flames* leſſening by Degrees until it quite extinguiſh: The internal, Shortneſs of *Breath*. I never heard of any great Inconvenience, which any one ſuffer'd by it, who eſcaped *ſwooning*. Thoſe that ſwoon away, and eſcape an abſolute *Suffocation*, are at their firſt Recovery tormented with violent *Convulſions*, the Pain whereof, when they begin to recover their Senſes, cauſeth them to roar exceedingly. The ordinary Remedy is to dig a Hole in the Earth, and lay them on their Bellies, with their Mouths in it; if that fail, they tun them full of *Good Ale*: But if that fail, they conclude them deſperate. I have known ſome, who have been recovered after this Manner, (when ſome of their Companions have at the ſame time died) that told me, they found themſelves very well within a little time after they had recovered their ſenſes, and never after found themſelves the worſe for it.

By Mr. Jeſſop, n. 117. p. 391.

They call the 2*d* ſort the *Peaſe-bloom Damp*, becauſe, as they ſay, it ſmells like *Peaſe-bloom*. They tell me, it always comes in the *Summer-time*; and thoſe *Grooves* are not free, which are never troubled with any other ſort of *Damps*. I never heard that it was mortal; the Scent perhaps freeing them from the danger of a Surprize; But by reaſon of it, many good *Grooves* lie idle at the beſt and moſt profitable time of the Year, when the *ſubterraneous Waters* are at the loweſt. They fancy it proceeds from the Multitude of *Red Trifoil Flowers*, by them called *Honey Suckles*, with which the Lime-ſtone Meadows in the *Peake* do much abound.

The 3*d* is the ſtrangeſt and moſt peſtilential of any, if all be true which is ſaid concerning it. Thoſe who pretend to have ſeen it (for it is viſible) deſcribe it thus: In the higheſt part of the *Roof* of thoſe Paſſages which branch out from the main *Groove*, they often ſee a round thing hanging, about the bigneſs of a *Foot-ball*, covered with a Skin of the *Thickneſs* and *Colour* of a *Cob-web*. This, they ſay, if by any Accident, as the *Splinter* of a *Stone*, or the like, it be broken, immediately diſperſeth it ſelf, and ſuffocates all the *Company*. Therefore to prevent *Caſualties*, as ſoon as they have eſpied it, they ſay, they have a way, by the *Help* of a *Stick* and a long *Rope*, of breaking it at a diſtance; which done, they purify the Place well with Fire, before they dare enter it again. I dare not avouch the Truth of this Story in all its circumſtances, becauſe the Proof of it ſeems impoſſible, ſince they ſay it kills all that are likely to bear Witneſs to all the particulars; neither dare I deny, but ſuch a thing may have been ſeen banging on the Roof, ſince I have heard many affirm it. Our *Under-ground Philoſophers* ſay, The *Steam* which ariſes from their Bodies and the Candles, aſcends into the higheſt part of the Vault, and there condenſeth, and in time has a Film grown round about it, and at length corrupting, becomes peſtilential.

The *4th*, which they alſo call a *Damp*, (altho' how proper I will not argue) is that Vapour, which being touch'd by the Candle, preſently takes Fire, and giving a Crack like a *Gun*, produceth the like Effects, or rather thoſe of *Lightning*. A Fellow they commonly call *Dobby Leech*, is at this day a ſad Example of the Force of one of thoſe Blaſts in *Haſleberg-Hills*, having his Arms and Legs broken, and his Body ſtrangely diſtorted.

Captain *Wain* told me, he ſaw one of them in a *Bloomery* near *Peniſton*.

N° 119. 450. This *Fulminating Damp* has lately done ſome Hurt in a Coal-pit at *Wingerſworth*, two Miles from *Cheſterfield*.

The *Shaft* of the *Coal-pit* is about 15 Yards deep; the Soil a ſtiff Mire, ſhaly about the middle of the *Shaft*, dry at the *Bottom*, (as they ſay) tho' I obſerved ſome Moiſture about the middle) and without any *Quarry* of *Stone*, the Stones in the Field about it are Grit-ſtone. It lies almoſt at the *Bottom* of a riſing Ground, being encompaſſed with Hills on all ſides, except towards the Eaſt, or rather South-eaſt.

There are 3 Pits which lie almoſt in a direct Line, the middlemoſt of which is that we ſpeak of. There is alſo a *4th* which ſtands a little higher than the reſt.

From the *Bottom* run 4 *Binks*, as they call them; 4 Yards wide, and 40 Yards long, except that in which they meet the fiery Damp, which wants 4 or 5 Yards of its due length.

The Bink in which the Damp is, is the fartheſt from the Air, which is communicated from the other *Pits*.

The *Soil* of this *Bink* (as they tell me) is a ſtiff Clay; neither can they find in it the ſign of any *Mineral*, except *Coal* and *Shale*. The *Coal* they ſay is abſolutely free from the *Pyrites*, with which moſt of our *Coals* are infected.

The *Bink* in which the *Damp* is, was wrought forward 20 yards on *Whitſon Monday* 1675, when *Geo. Mitchell* (one of my Informers) going in to fetch ſome of his Tools, with a Candle in his Hand, and coming within 4 or 5 Yards of the further end, found himſelf on a ſudden he knew not how, invironed with Flames. His Face, his Hands, his Hair, and a great part of his Clorths were very much burnt. He heard very little Noiſe, altho' one *Edward Mitchel*, who was working at the ſame time in another *Bink*, told me, that both he, and thoſe that ſtood above Ground, heard a very great one, like a Clap of Thunder, and that the Earth ſhaked, ſo that he was afraid, the Roof would have fallen in and buried him.

This being the firſt Accident of this nature, thoſe without ran in a great amazement, with their Candles in their Hands to ſee what the matter was, which were twice extinguiſhed, but held in upon the 3*d* Lighting; they ſaw nothing, but met with an intolerable Stench of Brimſtone, and an Heat as ſcalding as an Oven half Heated, (for that was their Expreſſion,) and forced them very ſpeedily to quit the Place.

Notwithſtanding this, they wrought forwards for about 3 Weeks, and carried it on till betwixt 30 and 40 Yards, until one *Henry Turnelly* met with the ſame Accident, which had formerly befallen *Mitchell*, and *Mitchell* had alſo the *Misfortune* to have his *ſhare* in this; for being by chance under *ground* at the Mouth of the *Bink*, he was ſhot forth for about 2 or 3 Yards, and had his Head broken, and his Body bruiſed againſt the further ſide.

About a Week after, *Edward Mitchell*, another of my Informers, adventuring in again, met with the ſame Miſfortune, and was worſe ſcorched than any of the reſt.

The Things I chiefly took notice of, were theſe,

1. That thoſe who were in the *Bink* whilſt it was fired, never heard any more Noiſe than that which is uſually made by a Flaſh of Gun-powder in the open Air, although thoſe in the other *Binks* and out, heard a very great one.

2. It ſhot off the *Turn* at the Mouth of the Pit, and ſmall Coals with other Rubbiſh from the bottom, into the Air, to a conſiderable Height.

3. They could perceive no Smell before the Fire, but afterwards a very ſtrong Smell of Brimſtone.

4. They uſed to go with their *Candles* low, as near as could be to the Bottom, becauſe they perceived the Vapour to lie towards the Roof, which if they held their Candles higher than ordinary, they could ſee deſcend like a black Miſt, and catch hold of the Flame, lengthen it to two or three handfuls, which would nevertheleſs burn after the uſual Manner, without any further Miſchief, if they ſuddenly held down their Hands cloſe to the Ground.

5. The *Flame* would continue in the *Vault* for 2 or 3 Minutes after the *Crack*; the laſt time, which was the moſt violent, they thought it continued about *half a Quarter* of an *Hour*.

6. The Colour of the *Flame* was blue, and very bright, ſomething inclining towards green.

7. Altho' they told me, they were ſenſible of no Smell, before the Kindling of the Vapour, yet the *Colliers Cloaths* that worked in the adjoining Pits, ſmelt very ſtrong of Brimſtone, which makes me ſuſpect all the Pits to be infected, altho' the Air ſecures them from Miſchief. Their Inſenſibility I aſcribe to the Cuſtom.

To the Queries ſuggeſted by Mr. *Boyle*, I anſwer as followeth,

1. That *Damps* are generally obſerved to come about the latter end of *May*, and to continue during the Heat of Summer, and in thoſe places which have *Damps* all the Year long, yet they obſerve them to be moſt violent at that Seaſon. And I could meet with no other certain Rule for any *periodical Returns*, except this *Annual*; altho' it be certain they do often return in the ſame Summer.

2. I never heard of any *Damps* that kindled of themſelves, altho' I have been told, that in ſome places they have been kindled by the motion of the Sled in which they draw their Coals.

3 Damps generally are held to be heavier than the Air, but this was manifeſtly lighter, for it lay towards the top of the Bink.

4. Upon the breaking of the *fulminating Damp*, there proceeded a dark Smoke, of the Smell and Colour of that which proceeds from Gun-powder Fired.

5. Many *Damps* are ſeen, but many alſo are not ſeen; which whether they be viſible or no is hard to tell, but I ſuppoſe all would be viſible, had we a convenient Light to view them by; becauſe be they either thicker or thinner than the Air, that Denſity or Thinneſs will occaſion a Refraction, and that muſt needs render them viſible.

6. Some *Damps* will quite extinguiſh all thoſe Fires that are let down into them, be they never ſo many ſucceſſively, or never ſo great; and Fire is obſerved to be ſo far from *Curing*, that it often creates *Damps* in places not otherwiſe ſubject to them. Indeed they are a preſent Remedy, if you can ſo order them, as by their Help to make a Circulation of the Air, through the infected place; otherwiſe, they do Hurt; and thoſe *Grooves* wherein they are forced to break their Rocks by the Help of great Fires, are ſeldom free from *Damps*.

7 Men uſually work in places infeſted either by the Fulminating or other *Damps*, after they ſuppoſe the *Vapour* ſpent.

8. *Damps* are common both in wet and dry Ground; but I cannot tell in which moſt.

9. *Damps* are obſerved to be moſt peſtilential, and to kill the ſuddeneſt, that are in *Grooves* not ſtirred for many Years, eſpecially if ſuch *Grooves* have formerly had great Fires in them.

10. The general Opinion of our Workmen is, That there are ſome *Damps* which kill, by reaſon of the noiſome *Steam*, and others meerly by want of *Air*; which latter Opinion I have heard diſallowed by the more experienced ſort: For they ſay, that there is no *Groove* that wants Air, be it never ſo deep; but the Air *ſtagnating* in very deep *Grooves* or *Pits*, the groſſer parts muſt needs at length ſeparate themſelves by their own weight, and ſubſiding to the *Bottom*, there corrupt, and conſequently get *malignant Qualities*, eſpecially in the *Summer time*, when the Sun promotes the *Fermentation*. Beſides this, the ſtanding *Air* being in a ſhort time filled with the *Vapours*, ariſing from Men's Bodies, and the *Steams* of *Candles*, and paſſing ſo often thro' the Lungs of the *Workmen*, is quickly rendred unfit for that uſe (whatſoever it is) to which *Reſpiration* is accommodated; and this they take to be the moſt frequent Cauſe of ordinary *Damps*.

Damps will often follow the *Water*, and particularly this ſort of fiery *Damp*, if I am rightly inform'd.

By Mr. Rog. Moſtyn, n. 136. p. 895. 4. The *Coal-work* at *Moſtyn* in *Flintſhire* lies in a large parcel of Woodland, which hath a great Fall directly North to the Sea-ſide; but the Dipping or Fall of the *Coal* partly croſſing the Fall of the Ground, is within a point of due Eaſt, and lies 40, 50, and ſometimes 60 yards under the level of the Sea. This Work is upon a Coal of Five Yards in Thickneſs, and hath been begun upon, about 6 or eight and thirty years ago. When it was firſt found, it was extream full of *Water*, ſo that it could not be wrought down to the *bottom* of the *Coal*, but a *Witchet* or *Gave* was driven out in the middle of it upon a *Level* for gaining Room to work, and drawing down the *Spring* of *Water* that lies in the *Coal* to the Eye of the Pit, in driving of which *Witchet*, after they had gone a conſiderable Way under ground, and were ſcanted of *Wind*, the *Fire-damps* did begin by little and little to breed, and to appear in *Creviſes* and *Slits* of the *Coal*, where *Water* had lain before the opening of the *Coal*, with a ſmall *blewiſh Flame*, working and moving continually, but not out of its firſt *Seat*, unleſs the *Workmen* came and held their *Candles* to it, and then being weak, the Blaze of the Candle would drive it with a ſudden Fizz, away to another *Crevice*, where it would ſoon after appear blazing and moving as formerly. This was the firſt Knowledge of it in this Work, which the *Workmen* made but a ſport of, and ſo partly neglected it, till it had gotten ſome ſtrength; and then upon a Morning, the firſt Collier that went down going forwards in the *Witchet* with his Candle in his Hand, the *Damp* preſently darted out violently at his Candle, that it ſtruck the Man clear down, ſinged all his Hair and Cloaths, and diſabled him for working a while after. Some other ſmall Warnings it gave them, inſomuch that they reſolved to employ a Man on purpoſe, that was more reſolute than the reſt, to go down a while before them every Morning to chaſe it from place to place, and ſo to weaken it. His uſual manner was to put on the worſt Rags he had, and to wet them all in *Water*, and as ſoon as he came within the danger of it, then he fell down grovelling on his Belly, and went ſo forward, holding in one hand a long *Wand* or Pole, at the end whereof he tied Candles burning, and reached them by degrees toward it, then the *Damp* would fly at them, and if it miſſed of putting them out, it would quench it ſelf with a Blaſt, and leave an ill ſcented Smoke behind it. Thus they dealt with it till they had wrought the Coal down to the bottom, and the *Water* following, and not remaining as before in the Body of it, among *ſulphurous* and *braſſy Metal* that is in ſome Veins of the Coal, the *Fire-damp* was not ſeen nor heard of till the latter End of the Year 1675, which happen'd as followeth.

After long working of this Coal, it was found upon the riſing Grounds, that there lay another *Roach* of Coal, at the *Depth* of 14 Yards under it, which proved to be 3½ Yards thick, and ſomething more *ſulphurous*. This encouraged us to ſink in one of the Pits we had formerly uſed on the 5 *Yards Coal*; and we ſunk down 20 Yards before we came to the ſaid *Roach*, in regard it was at the *Sea-ſide*, and upon the loweſt of the *Dipp*, where the Rocks ſucceſſively thicken as they fall. As we ſunk the lower part of it, we had many Appearances of the *Fire-damp* in *watry Crevices* of the Rocks, we ſunk thro' *Flaſhing* and *Darting* from ſide to ſide of the Pit, and ſhewing *Rain-bow-colour like* on the ſurface of the Water in the Bottom; but upon drawing up of the Water with Buckets, which ſtirr'd the Air in the Pit, it would leave burning, till the Colliers at Work, with their Breath and Sweat, and the Smoke of their Candles thickned the Air in the Pit, and then it would appear again; they lighted their Candles in it ſometimes when they went out, and ſo in this Pit it did no further Harm.

But being deſirous to get the Work in ſome forwardneſs before *Summer*, (when the *Heat* of the *Weather* at ſometimes, and the *Cloſeneſs* of the *Air* in foggy Weather at other, occaſions the *ſmoothering Damp*) it was reſolved for *Expedition-ſake*, and ſaving of ſome Charges, to ſink a Pit within the *Hollows* or *Deads* upon the *upper Work*, at 16 or 17 Yards diſtance from the *firſt Pit*. This we proceeded in till we came 6 or 7 yards deep ; then the *Fire-damp* began to appear as formerly, accompanying the *Workmen* ſtill as they ſunk, and they uſing the ſame means as afore, ſometimes blowing it out with a *Blaſt* of their *Mouth*, at other times with their *Candles*, or letting it blaze without *interruption*. As we ſunk down, and the *Damp* got ſtill more and more ſtrength, we found that our want of *Air* perpendicularly from the Day, was the great *Cauſe* and *Nouriſher* of this *Damp* ; for the *Air* that followed down into this *Pit*, came down at the firſt ſunk *Pit*, at the forementioned diſtance, after it had been diſperſed over all the old *Hollows* and *Deads* of the former *Work*, that were filled up with *noyſome Vapours*, thick ſmothering Fogs, and in ſome places with the ſmothering *Damp* it ſelf. Nevertheleſs we held on ſinking, till we came down to 15 Yards, plying the Work Night and Day, (except *Sundays* and *Holidays*) upon which Intermiſſion, the Pit being left alone for 48 Hours and more, and the Damp gaining great ſtrength in the *Interim*, by that time the *Workmen* went down, they could ſee it flaſhing and ſhooting from ſide to ſide like *Sword-blades* croſs one another, that none durſt adventure to go down into the Pit. Upon this they took a Pole, and bound *Candles* ſeveral times to the end of it, which they no ſooner ſet over the Eye of the Pit, but the *Damp* would fly up with a long ſharp Flame and put out the *Candles*, leaving a foul Smoke each time behind it. Finding that theſe things would not allay it, they adventured to bind ſome *Candles* at a Hook hanging at a Rope's end, that was uſed up and down in the Pit : When they had lower'd down theſe a little Way into the *Shaft* of the Pit, up comes the *Damp* in a full body, blows out the Candles, diſperſeth it ſelf about the Eye of the Pit, and burneth a great part of the Men's Hair, Beards and Cloaths, and ſtrikes down one of them, in the mean time making a Noiſe like the lowing or roaring of a Bull, but lowder, and in the end leaving a Smoak and Smell behind it worſe than that of a Carrion. Upon this diſcouragement, theſe Men came up and made no further Trial ; after this, the Water that came from it, being drawn up at the other pit, was found to be blood-warm, if not warmer.

In this Juncture, there was a Ceſſation of the Work for 3 Days, and then the *Steward* thinking to fetch a Compaſs about from the Eye of the Pit, that came from the Day, and to bring Wind by a ſecure a long way with him, that if it burſt again it might be done without danger of Men's Lives, went down and took 2 Men along with him, which ſerved his turn for this purpoſe. He was no ſooner down, but the reſt of the Workmen that had wrought there, diſdaining to be left behind in ſuch a time of Danger, haſted down after them, and one of them more indiſcreet than the reſt, went headlong with his Candle over the Eye of the *Damp-pit*, at which the *Damp* immediately catched, and flew to and frow over all the Hollows of the *Work*, with a great Wind, and a continual Fire, and as it went, keeping a mighty great roaring Noiſe on all ſides.

The Men at firſt appearance of it had moſt of 'em fall'n upon their faces, and hid themſelves as well as they could in the looſe *Sleck* or *Small-coal*, and under the ſhelter of Poſts, yet never the leſs the Damp returning out of the Hollows, and drawing towards the Eye of the Pit, it came up with incredible force; the Wind and Fire tore moſt of their Cloaths off their Backs, and ſinged what was left, burning their Hair, Faces and Hands, the blaſt falling ſo ſharp on their Skin as if they had been whipt with Cords; ſome that had leaſt Shelter, were carried 15 or 16 Yards from their firſt Station, and beaten againſt the Roof of the Coal and ſides of the Poſts, and lay afterwards a good while Senſeleſs, ſo that it was long before they could hear or find one another. As it drew up to the Day Pit, it caught one of the Men along with it that was next the Eye, and up it comes with ſuch a terrible Crack, not unlike but more ſhrill than a Cannon, that it was heard 15 Miles off with the Wind, and ſuch a Pillar of Smoak as darkned all the Sky over head for a good while. The brow of the Hill above the Pit was 18 Yards high, and on it grew Trees 14 or 15 Yards long, yet the Man's Body and other things from the Pit, were ſeen above the Tops of the higheſt Trees at leaſt 100 Yards. On this Pit ſtood a Horſe Engine of Subſtantial Timber and ſtrong Iron Work, on which lay a Trunk, or Barrel, for winding the Rope up and down, of above a 1000 pounds Weight, it was then in motion one Bucket going down, and the other coming up full of Water: This Trunk was faſtened to that Frame with Locks and Bolts of Iron, yet it was Thrown up and carried a good way from the *Pit*, and pieces of it, though bound with Iron Hoops and ſtrong Nails, blown into the Woods about; ſo likewiſe were the two Buckets, and the Ends of the Rope, after the Buckets were blown from them, ſtood a while upright in the Air like Pikes, and then came leiſurely drilling down. The whole frame of the Engine was ſtirr'd and mov'd out of its place, and thoſe Men's Cloaths, Caps, and Hats, that eſcaped, were afterwards found ſhattered to pieces, and thrown amongſt the Woods a great way from the Pit. This happened the 3d of *Feb.* 1675, being a Seaſon when other Damps are ſcarce felt or heard of.

By Mr. Jo. Beaumont. Phil. Col. N° 1. p. 6.

5. About 2 Miles on the South Eaſt of *Stony Eaſton*, at a Place nearly bordering to *Mendipp-Hills*, begins a Running of Coal conſiſting of ſeveral *Veins* which extends it ſelf towards the Eaſt about 4 Miles. There is much Working in this *Running*, and Fire Damps continually there happen: So that many Men of late Years have been there Kill'd, many others Maimed, and a Multitude Burnt Some have been blown up at the Work's Mouth; the *Turn Beam* (which hangs over the Shaft) has been thrown off it's Frame by the force of it; and thoſe other Effects whereof you had an Account from other Places are generally found. The Middle and more Eaſterly parts of this *Running* are ſo very ſubject to thoſe Fiery Damps, that ſcarce a Pit fails of them: Notwithſtanding which, our Colliers ſtill purſue their Work; but to prevent Miſchief, they keep their Air very quick, and uſe no Candles in their Works but of a Single Wick, and thoſe of 60 or 70 to the Pound, which nevertheleſs give as great a Light there, as others of 10 or 12 to the Pound in other places, and they always place them behind them, and never preſent them to the Breaſt of the Work.

When any are Burnt, the uſual Method they obſerve in their Cure is thus: They preſently betake themſelves to a good Fire, and ſending for ſome *Cow's* Hot Milk, they firſt Bath the burnt places with that; when they have done this a while, they make uſe of an Ointment proper for Burnings, which the Maſters of the Works have always in a readineſs for ſuch Chances, being furniſhed therewith at the Cheap rate of 12 Pence the Pound by a Good old Woman living near the Works.

The Colliers aſſure me, That theſe Works are apt to take Fire all the Year, which it will freely do at any time if a Candle be carry'd within Air: But moſt and with moſt Violence in the Winter, and chiefly in a *Black Froſt*, when the Air runs beſt; That the Danger of Firing is alike both in wet and dry Grounds; and that there are no Fumes coming out of the Mouth of any Shaft which will be Lighted by a Candle or Torch.

I have heard of one Damp here, which took Fire of it ſelf, and kindled the Vein of Coal which burnt a conſiderable time before it went out.

Our *Damps* lie as well towards the Bottom or Seal of the Work, as towards the *Roof*, it being nothing but an inviſible *Sulphureous Breath* expanded through the whole Work.

I cannot perceive at the Mouth of any Shaft or underſtand by any Workman, of any unuſual Wind or Current of Vapours coming from beneath. In wet Works there are many times Bubbles on the Surface of Water there ſtanding, which will preſently take Fire if a Candle be held to them: But I cannot find that thoſe Bubbles are cauſed by any *Subterraneous Breath*, but riſe from the falling of Coal into the Water, or from Dropping of Water from the Roof, as we ſee they do in Ponds from drops of Rain in the Summer.

I may here further acquaint you, as a Novelty, that this laſt Summer 1679 two *Fire Damps* happen'd in our *Lead Mines* on *Mendipp-Hills*: But they were of ſo ſmall a Force, that the Workmen received no prejudice by them.

A Well and Earth in Lancaſhire, *taking* Fire *at a Candle By Mr.* Tho. Shirly. n. 26. p. 482.

VIII. About the latter end of *Feb.* 1659. returning from a Journey to my Houſe in *Wigan*, I was entertained with the relation of an odd Spring ſituated in one Mr. *Hawkley's* Ground (if I miſtake not) about a Mile from the Town, in that Road which leads to *Warrington* and *Cheſter*; the People of this Town did confidently affirm, that the Water of this Spring did burn like Oil.

When we came to the ſaid Spring (being 5 or 6 in company together) and applyed a Lighted Candle to the Surface of the Water, 'tis true, there was ſuddenly a large Flame produced, which Burnt vigorouſly: But obſerving that this Spring had its Eruption at the foot of a Tree, growing on the top of a Neighbouring Bank, the Water of which Spring filled a Ditch that was there, and covered the Burning Place, I applyed the lighted Candle to divers parts of the Water, contained in the ſaid Ditch, and found as I expected, that upon the touch of the Candle and the Water, the Flame was Extinct.

Again, having taken up a Diſh full of Water at the *Flaming place*, and held the Lighted Candle to it, it went out. Yet I obſerved that the *Water* at the Burning-Place did Boyle, and heave like Water in a Pot upon the Fire, though my Hand put into it perceived it not ſo much as Warm.

This Boyling I conceived to proceed from the Eruption of ſome *Bituminous* or *Sulphureous Fumes*; conſidering this place was not above 30 or 40 Yards diſtant from the Mouth of a *Coal-Pit* there; and indeed *Wigan*, *Aſhton*, and the whole Country, for many Miles compaſs, is underlaid with *Coal*. Then applying my hand to the Surface of the *Burning-Place* of the *Water*, I fouud a ſtrong *Breath*, as it were a Wind, to bear againſt my Hand.

When the Water was drained away, I applyed the Candle to the Surface of the dry *Earth*, at the ſame point where the *Water* burned before; the *Fumes* took *Fire* and burned very Bright and Vigorous. The *Cone* of the *Flame* aſcended a foot and an half from the Superficies of the *Earth*: And the *Baſis* of it was of the compaſs of a Man's Hat about the Brims. I then cauſed a Bucket full of *Water* to be poured on the *Fire*, by which it was preſently Quenched. I did not perceive the *Flame* to be *Diſcoloured* like that of *Sulphureous Bodies*, nor to have any manifeſt *Scent* with it. The *Fumes*, when they broke out of the *Earth* and preſs'd againſt my Hand, were not, to my beſt remembrance, at all Hot.

IX. This *Subterraneal Fire* keeps no Analogy with other *Vulcano*'s; It increaſeth or Decreaſeth according to the Subject it feedeth on: Which is, for the moſt part, a *Day-Coal* (as they call it) for the *Upper Seam* of the *Coal* next expoſed to the Air, ſo that you may Light a Candle at it in ſome Places, in other places it is ſome Fathoms deep, according as the *Day-Coal* heightens or deepens.

A Subterraneal Fire in a Coal Mine Newcaſtle; *By Dr.* Lucas Hodgeſon n. 130. p. 762.

No *Sal-Armoniack*, nor any thing like it to be found except where an Actual *Fire* hath come. There being a mixture of the *Steams* of *Sal-Armoniack* and *Sulphur* riſing together in moſt places, it is hard to diſtinguiſh them; for though the *Flowers* of *Brimſtone* ſeem to Riſe firſt, yet there is commonly a Cruſt of *Sal-Armoniack* under them.

There is a *Milky Subſtance* which is found no where, but where the *Sal-Armoniack* and *Sulphur* are totally gone, and the *Acid* part or *Aluminous Spirit* of that White Maſs will alſo take Wing by the Increaſe of the *Fire*, leaving a *Caput Mort.* Dry, Stiptick, and as hard as a Stone; yet I account that a Pound of this Maſs, before the *Fire* preſs too much upon it, will go near to afford by *Solution*, &c. Half a Pound of tolerable *Cryſtallin Alum*.

The Neighbouring Soil differs little from other grounds with us, having neither *Common Salt*, nor *Niter* in it; for though there be a *Salt-Well* with us, yet it is both on the other ſide of *Tyne*, and a conſiderable diſtance from the *Fire*.

I have induſtriouſly obſerved the *Springs* that are near the *Fire*, and find none of them that give the leaſt ſuſpicion of *Sal-Armoniack*. The *Water* that runs from the adjacent *Collieries* is [illegible], giving as deep a Tincture with *Galls* as *Scarborough-Spaw*. In a word, it differs nothing from the Water that ordinarily drown our *Collieries*, and coſt our *Coal* owners ſo much to be quit of them. The other *Springs*, moſt of which are dry this Year, (1676) are of Ordinary uſe, containing no *Mineral Salts* in them. But I hope you will ceaſe to wonder, that *Coal* ſhould produce a *Volatile Salt* by the Action of the *Fire*, ſeeing I have gathered *Sal-Armoniack* from a burning *Brick Kiln*, where nothing but *Clay* and *Coal* are burnt together, and I hope none will expect the *Volatile Salt* in the *Sal-Armoniack* from ordinary *Clay*. The reaſon which firſt prompted me to ſeek this Salt there, was that the Smell of the *Kiln* did ſomewhat reſemble that of the *Subterraneal Fire*. There is alſo a ſort of *Mineral* we call a Slate, which is partly *Coal*, partly *Alum-ſtone*, partly *Marcaſite*, which being laid up in Heaps and Burnt, are uſed for hardning the Coal-ways; upon theſe Heaps, whilſt Burning, I have often gathered both *Brimſtone* and *Sal-Armoniack*.

When I pour'd Cold Water upon the Powdred *Marcaſite*, it produced a *Vitriolime Water*, but no Heat.

As to the reſemblance betwixt this *Sal-Armoniack* and that which comes from Mount *Ætna*, where no Coals are ſuppoſed to be, whence it ſeems to follow, that our *Volatile Salt* may proceed from ſomewhat elſe than Coal; to which difficulty I Anſwer, that when I deduced ours from Coal, I did not exclude other *Bituminous* Subſtances that are Analogous to it, of which I ſuppoſe the Country, where Mount *Ætna* is, affordeth no Inconſiderable Quantity; neither will it follow that no Coals have been wrought, therefore there are none; and if Tryal hath been made, and no Coals found; yet it will be a doubt ſtill whether thoſe Tryals have been ſufficient. However it be, yet I think it were not impertinent (by the way) to enquire, whether the Sagacious *Venetians*, may not be beholden to Mount *Ætna*, or ſome other *Subterraneal Fires*, for the great quantity of *Sal-Armoniack* they ſell to our Merchants; for this *Fire* affordeth no Inconſiderable Quantity thereof, eſpecially in dry Weather.

Though it may ſeem incredible to ſome, that Black Coal ſhould yield a *White Snowy Volatile Salt*, yet they that know that all *Volatile Salts* whatever may be freed from their *Fœtor* and Intenſe Colour, by tranſmuting them into a *Sal-Armoniack* by the Mediation of an *Acid*, as Spirit of Salt, Spirit of *Vitriol*, *Alum*, &c. And then Subliming them till they be White, will ceaſe to doubt of this matter. The reaſon of which Change, I preſume is, becauſe, though theſe *Volatile Salts* carry over always ſome of the *Fœtid Oyl* with them while in a ſtate of *Volatility*, yet being thus in a manner Fixed, the *Fœtid Oyl* muſt neceſſarily by force of Fire riſe firſt, leaving the ſubſequent *Compound Salt*, or *Sal-Armoniack*, without Smell; though it is ſtill a doubt, whether the *Volatile Salt* is *Better* or *Worſe* for this Labour.

We have no *Petreſcent* Springs near us; but there is a *Cave* ſome Miles off, at the fartheſt end of which few have been, from the Roof of which hang large Lumps of *Petrefied Water*, like *Icicles*, ſome of them reaching down to the Ground like Pillars; theſe *Icicles* are good *Limeſtone*, as I have *Tried*.

An Eruption of Fire near Fierenzola; *By Dr.* Rob. St. Clair. n. 245. p. 378.

X. I have lately received an Account from my Brother, that on a ſide of one of the *Appennine Mountains* half way betwixt *Bologna* and *Florence*, near a Place called *Petra Mala*, about 5 Miles from *Fierenzola*, there is a ſpot of Ground about 3 or 4 Miles Diameter, which inceſſantly ſends up a Flame riſing very high, without Noiſe, Smoak, or Smell; yet it gives a very great Heat, and it has been obſerved to be thus in all times except of great Rains, which put it out for a time; but when that is over it Burns with greater Vigour and Heat than before. The Sand about it, when turned up, ſends up a Flame: but within 3 or 4 Yards of it there grows Corn all round about; for it continues always in the ſame Spot.

This Flame ſeems to proceed from a Vein of *Bitumen* or *Naptha*, that *Crops* (as the *Miners* call it) only here; which when by Plowing, or ſome other Accident, the upper Cruſt has been turned up, was Kindled into a Flame by the Heat and Agitation of the Air, as other *Salino-Sulphureous* Bodies are, of which Eſquire *Boyle*'s *Phoſphorus* is a particular Inſtance. The like *Spontaneous Aſcenſion* is ſeen in many *Mineral* Subſtances, but none that I know of, ſo Quick in its Production, or ſo laſting, as this is, the whole Wood and Fields having been deſtroyed by them. The Neighbours there have been ſo little Curious to obſerve it, that they believed there was a great Hole in the Flame-Place; but he found it to be firm Ground. Neither does any there Remember when and upon what Occaſion it firſt began. The *Flaming Well* near *Wigan* ſeems to proceed from a Cauſe much like this, in which you may Boil an Egg, and upon the approaching of a Lighted Candle it takes Fire; both ſeem to proceed from a *Naphtha* or *Subtile Bitumen*, only that in a hotter Country, and being in a dryer Soil, is more Subtile and Inflammable; juſt as the *Petroleum* which is to be found in *Italy* is a White like *Spirit* of *Turpentine*, and is more Penetrating than the *Petroleum* which is to be found in the Northern Countries; an inſtance of which we have in a *Well* two Miles diſtant from *Edinburgh*, called the *Baulme Well*, of a Black Red Colour and very Thick, but being Diſtilled, does in Colour, Taſte and Smell, reſemble that of *Italy*.

The *Spontaneous Aſcenſion* of the *Naphtha* ſeems to be made out by the Smell that our *Bitumen* near *Edinburgh* yields, being moſt like *Coal Smoak*. There are three ſuch Fires on the ſame Hills that are Extinguiſh'd in the Summer, but Burn in the Winter; the reaſon of which I judge to be, that the Bowels of the Earth being Cooler in Summer than in Winter, do not ſend forth that Quantity of thoſe *Subtile Exhalations* as may be ſufficient to maintain a Flame in Summer; but in Winter, the Bowels of the Earth being Hotter (which is made evident by the Smoaking of Springs in Winter and not in Summer, and the Experience of Miners) greater Plenty of Steams are ſent forth which in the Air are agitated into a Flame, the Brisk Motion of the Parts one againſt another, being promoted by the Subtilty and Brisk Motion of the *Aerial* Particles, *quæ mutuas dant Operas*.

An Hiſtorical Account of the Eruptions of Mount Ætna; *By* Mr. Oldenburg. n. 48 p. 967.

XI. To paſs by what is related by *Beroſus*, *Orpheus*, and other leſs credible Authors, about the Eruptions of this Mountain, both at the time of the Ingreſs of the *Ionian Colonies* into *Sicily*, and that of the *Argonauts* (which latter was in the 12th *Age* before the *Chriſtian* Account;) we ſhall firſt take notice of that, which happen'd at the time of the Expedition of *Æneas*, who being terrify'd with the Fire of this then Burning Mountain, left that Iſland; whereof *Virgil* gives a notable Deſcription.

Lib. 3 Æneid

After this we find in *Thucydides*, that in the 76 *Olympiad*, which is about 476 *before Chriſt*, there was another Fire, and abont 50 Years after that Another.

Then, in the time of the *Roman Conſuls* there happen'd 4 *Eruptions* of *Ætna*, recorded by *Diodorus Siculus* and *Polybius*.

The next was in the time of *Julius Cæſar*, related by the ſaid *Diodorus* to have been ſo Fierce, that the Sea about *Lipara* (an Iſland near *Sicily*) by its fervent Heat, burnt the Ships and killed all the Fiſhes thereabout.

Another we read of in the Reign of *Caligula* about 40 Years *after Chriſt*, which was ſo Dreadful, that it made that Emperor, then being in *Sicily*, to Fly for it.

About the Martyrdom of the Romiſh S. *Agatha* it *Burned* again very Fiercely; though ſome ſay, that by Vertue of her Interceſſion it was ſtay'd from reaching *Catania*.

Again it Burnt *A C.* 812, in the Reign of *Charles M.*

Then from the Year 1160 to 1169, whole *Sicily* was ſhaken with many terrible Earth-quakes, and the *Eruptions* of the ſame Mountain deſtroyed a vaſt Tract of Inhabited Land round about it, and Reached as far as *Catania*; the Cathedral of which it Deſtroyed; and the Religious Men living in it.

Again in the Year 1284, there happened another Terrible Fire about the time of the Death of *Charles* King of *Sicily* and *Arragon*.

A. 1329. until 1333, there was another.

A. 1408. another.

A. 1444. another which laſted till 1447.

A. 1536. another which laſted a Year.

A. 1633. another continuing ſeveral Years.

A. 1650. it Burnt on the North-Eaſt ſide, and Vomited ſo much Fire, that by the Fiery Torrents, cauſed thereby, great Devaſtation was made; as *Kircher* relates in his *Mundus Subterraneus*; whoſe aſſiſtance we have alſo made uſe of in the forgoing *Chronology* together with that of *Philotheus*.

The ſame Author, having been in *Sicily* himſelf, obſerveth that the People of *Catania*, digging for *Pumice Stones*, do find at the Depth of 100 *Palmes* (which is about 68 Feet) Streets, Paved with Marble, and many Footſteps of Antiquity; an Argument that Towns have Stood there in former Ages, which have been Overwhelmed by the Matter caſt out of this Mountain. They have alſo found ſeveral Bridges of *Pumice*

Stones, doubtleſs made by the Flux of Fiery Torrents, the Earth being very much Raiſed ſince.

An Eruption of M. Ætna in 1669 *by ſome* Engliſh Merchants. n. 51. p. 1028

XII. There was for the ſpace of 18 Days before this Fire broke out, a very Thick Dark Sky in thoſe parts, with Thunder and Lightning and frequent *Concuſſions* of the Earth, which the People make terrible reports of; though I never ſaw not heard of any Buildings caſt down thereby, ſave a ſmall Town or Village called *Nicoloſi*, about half a Mile diſtant from the New Mouth, and ſome ſuch other ſlight Buildings among thoſe Towns, that were after over-run by the Fire. Beſides, it was obſerved that the Old Top or Mouth of *Ætna* did, for 2 or 3 Months before, Rage more than uſual; the like of which did *Volcan* and *Strombolo*, two Burning Iſlands to the Weſtward. And the top of *Ætna*, much about the ſame time, have ſunk down into its Old *Vorago*, or Hole, in that 'tis agreed by all, that had ſeen this Mountain before, that it was very much lower'd.

It firſt Broke out on the 11th of *March* 1669, about two Hours before Night, and that on the South Eaſt Side or Skirt of the Mountains, about 20 Miles beneath the *Old-Mouth*; and 10 Miles from *Catania*. At firſt it was reported to advance 3 Miles in 24 Hours; but at our being there (*viz. April* 5) when we were come within a ſhort Mile of *Catania*, it ſcarce moved after the rate of a Furlong a Day; and after this Degree of Progreſs it continued for 15 or 20 Days after, paſſing under the Walls of *Catania* a good way into the Sea; but about the latter end of this Month, and the beginning of *May* (whether it was that the Sea could not receive this matter faſt enough, or rather that the Mouth above did caſt out a larger quantity) it bent all its force againſt the City; and having wrought it ſelf up even with the Walls thereof, over it paſſed in diverſe places; but its chief Fury fell upon a very pretty Convent, which was that of the *Benedictins*, having large Gardens and other Grounds betwixt them and the Wall: Which when it had filled up, it fell with all its Force on this Convent, where it met with ſtrong reſiſtance, which made it Swell, (as uſually it did, where it met with any obſtruction) almoſt as high, as the higher Shops in the old *London Exchange*, this Convent being built much after that faſhion, though conſiderably bigger. Some parts of this Wall were driven in, whole and entire, almoſt a foot, as appeared by the riſing of the Tiles in the midſt of the Floor, and bending of the Iron Bars that went croſs above. And 'tis certain, had this Torrent fallen in ſome other part of the Town, it would have made great Havock amongſt their Ordinary Buildings; but here its fury ceaſed upon the 4th of *May*, running henceforward in little Channels or Streams, and that chiefly into the Sea. It had overwhelmed in the Upland Country, ſome 14 Towns and Villages, whereof ſome were of good Note, containing 3 or 4 Thouſand Inhabitants, and ſtood in a very fruitful and pleaſant Country, where the Fire had never made any Devaſtation before: But now there is not ſo much as any ſign where ſuch Towns have ſtood; only the Church and Steeple of one of them, which ſtood alone upon an high Ground, does ſtill appear.

As to the Matter, which thus ran, it was nothing elſe but diverſe kinds of *Metals* and *Minerals*, rendred liquid by the Fierceneſs of the *Fire* in the

Bowels of the Earth, boyling up and guſhing forth, as the Water doth at the Head of ſome great River ; and having run in a full Body for a Stones caſt or more, the Extremity thereof began to Cruſt and Curdle, becoming when cold, thoſe Hard, Porous Stones which the People call *Sciarri*, having the neareſt reſemblance to huge Cakes of Sea-Coal full of a fierce Fire. Theſe came rolling and tumbling over one another, and where they met with a Bank, would fill up and ſwell over, by their weight bearing down any Common Building, and Burning up what was Combuſtible. The chief Motion of this Matter was forward, but it was alſo dilating it ſelf as a Flood of Water would do on even ground, thruſting out ſeveral Arms or Tongues, as they call them.

About 2 or 3 a Clock in the Night, we mounted an high Tower in *Catania*, whence we had a full view of the *Mouth*, which was a terrible ſight, *viz.* To ſee ſo great a Maſs or Body of meer Fire. Next Morning we would have gone up to the *Mouth* it ſelf, but durſt not come nearer than a Forlong off, for fear of being overwhelmed by a ſudden turn of the Wind, which carried up into the Air, ſome of that vaſt Pillar of Aſhes, which to our apprehenſion, exceeded twice the bigneſs of *Paul's Steeple* in *London*, and went up in a ſtreight Body to a far greater height than that ; the whole Air being thereabout all covered with the lighteſt of thoſe *Aſhes* blown off from the top of this Pillar : And from the firſt breaking forth of the *Fire* until its Fury ceaſed (being 54 Days) neither Sun nor Star were ſeen in all that Part.

From the outſide of this Pillar fell off great quantity of Stones, but none very big, neither could we diſcern any *Fire* in them, nor come to ſee where the Fiery ſtuff broke out, there being a great Bank or Hill of *Aſhes* betwixt it and us. At the Mouth, whence iſſued the *Fire*, or *Aſhes*: or both, was a continual noiſe, like the beating of great Waves of the Sea againſt Rocks, or like Thunder afar off, which ſometimes I have heard here in *Meſſina*, though ſituated at the foot of High Hills, and 60 Miles off. It hath alſo been Heard 100 Miles Northward of this place in *Calabria* (as I have been credibly informed) whither the Aſhes have been alſo carried : And ſome of our Seamen have alſo reported, that their Decks were covered therewith at *Zant*, though it is likely not very thick.

About the Middle of *May* we made another Journey thither, where we found the face of things much alter'd ; the City of *Catania* being 3 Quarters of it compaſſed round with theſe *Sciarri*, as high as the top of the Walls ; and in many places it had broke over. The firſt Night of our arrival, a New *Stream* or gutter of *Fire* broke forth among ſome *Sciarri*, which we were walking upon an hour or two before, and they were as high as to be even with the Top of the Wall. It poured it ſelf down into the City in a ſmall Gutter of about 3 foot broad, and 9 foot long of meer *Fire*, the Extremities ſtill falling off into thoſe *Sciarri* ; but this Stream was Extinct by the next Morning, though it had filled up a great void place with its *Sciarri*. The next Night was a much bigger Channel diſcovered, pouring it ſelf over another part of the Wall into the *Caſtle-Ditch*, which continued (as we were informed ſome

Vid. Cap. I. §. XXXIX.

Days after our Departure. Divers of thoſe ſmall Rivulets did run at the ſame Time into the Sea.

It was obſerved, that thoſe ſtreams of Fire never grew broader, nor viſibly longer, nor moved out of the place they were ſeen in, which puts us a little more to examine their working, and we did conclude, that not only then, but in the Fury alſo of its running, it made it ſelf certain cruſted Gutters to run in, to keep it ſelf, as it were, from the Air, which by Degrees did cool and fix it; as more plainly appeared above at the Mouth, where, the firſt Time of our going thither, we found the *Sciarri* generally thus cold and fixt. And hence alſo it might proceed, that theſe live *Sciarri*, meeting with any Bank or high Ground would puff and ſwell up, till they had overcome it; ſo that in many places, eſpecially under the Walls of *Catania*, were Valleys of thoſe *Sciarri*, and the Fire never broke forth, or diſcovered it ſelf in thoſe Streams, until it had gained its Height; for thoſe Rivulets ever went declining.

It having ſpent 2 days about *Catania*, we again went up to the Mouth, where now without any danger of *Fire* or *Aſhes*, we could take a free view both of the old and new *Channel* of the *Fire*, and of that great *Mountain* of *Aſhes* caſt up. That which we gueſſed to be the *old Bed* or *Channel*, was a three corner d ſpot of about 2 *Acres*, with a Cruſt or *Sciarri* at the *bottom*, and upon that a ſmall Cruſt or Surface of *Brimſtone*. It was hedged in on each ſide with a great Bank or Hill of *Aſhes*, and behind, and at the upper end roſe up that huge Mountain of the ſame matter. Between thoſe two Banks the Fire ſeems to have had its paſſage. At the upper end in the Nook, upon a little Hillock or cruſted *Sciarri*. was an *Hole* about 10 foot wide, whence it is probable the Fire iſſued, and it might have had ſeveral other ſuch Holes, ſince either cruſted over, or covered with Aſhes. At the bottom of this Hole the Fire was ſeen to flow along, and below it was a *channel* of *Fire*, beneath that ſurface of *Sciarri*, which being cleft atop for ſome ſpace, we had an eaſy and leiſurable view of the *Metal* flowing along, whoſe *ſuperficies* might be a Yard broad, tho' poſſibly it carried a great breadth underneath, the Gutter going ſloping. What depth it had we could not gueſs; it was impenetrable by iron Hooks, and other Inſtruments we had. We were very deſirous to have got ſome of this matter at the *Spring-head*, but we could penetrate no more into it, than with ones Finger into the Palm of the Hand. 'Tis likely that ſome running may have been more yielding than we found this. From this *Channel*, but eſpecially from that Hole above it, iſſued great ſtore of a ſtrong *ſulphurous Smoak*, wherewith ſome of our Company were at firſt almoſt ſtifled, thro' Inadvertency. About once in a quarter of an Hour, there would riſe a Pillar of Smoak, or Aſhes, but nothing comparable to the former, which ſeemed to come from the middle Top of that new made Mountain.

At this our laſt being at *Catania*, we found the People buſy in barricading the Ends of ſome Streets and Paſſages, where they thought the Fire might break in, and this they did by pulling down the old Houſes thereabouts, and laying up the looſe ſtones in manner of a Wall, which they ſaid would reſiſt the Fire, as not being mixt with *Lime*; though it was the great Weight and

Force of that fiery Matter in preſſing forward, and not its burning, that overthrew the Buildings, as plainly appeared in the Convent of the *Benedictins*, and in the *Town walls*, where the great Deluge of Fire did pour it ſelf; it not breaking into the City, but pouring it ſelf over the *Walls*, as hath been ſaid.

Unto this very time, 'tis ſaid to have run a Mile into the Sea, and as much in Front. tho' it was much leſs when we were there.. The Shore goes gently declining; having at the Extremity of the *Sciarri* about 5 Fathoms, and about half as much they are above Water. The Superficies of the Water, for 20 Foot or more of thoſe Rivulets of Fire, was hotter than to endure one's Hand in it, tho' deeper it was more temperate; and thoſe live *Sciarri* ſtill retained their Fire under Water, as we ſaw, when the Surges of the Sea retreated back in their ordinary Reverberations.

The general Face of theſe *Sciarri* is in ſome Reſpect not much unlike, from the beginning to the end, to the River of *Thames* in a great Froſt, at the top of the Ice above Bridge; I mean, lying after ſuch a rugged manner in great Flakes, but its Colour is quite different, being moſt of a dark dusky Blew, and ſome Stones or Rocks of a vaſt Bigneſs, cloſe and ſolid.

But notwithſtanding their *Ruggedneſs*, and ſtore of *Fire*, which we could ſee glowing in the Clefts and Cavities, we made a Shift to ramble over a good part of them; as 'tis ſaid alſo, that People would do the ſame in its greateſt violence of Burning. For as thoſe *live Sciarri*, and thoſe *Rivers* of *Fire* themſelves, were ſo tough and impenetrable as to bear any Weight, ſo the Superficies of the *Sciarri* might be touched and handled, the *Fire* being inward and not to be diſcerned but near hand, eſpecially in the Day-time: And 'twas ſomewhat a ſtrange Sight to ſee ſo great a River come ſo tamely forward; for, as it approached unto any Houſe, they not only at good leiſure removed their Goods, but the very Tiles and Beams, and what elſe was moveable.

I ſhall add, that the whole Country, from the very *Walls* of *Catania* to 20 Miles on this ſide, is full of thoſe old *Sciarri*, which former *Eruptions* have caſt forth, tho' the People remember none ſo big as this laſt, or that burſt out ſo low. This Country is notwithſtanding well cultivated and inhabited; for length of time hath either mollified much of thoſe old *Sciarri*, or new Moulds or Aſhes have overgrown them; tho' there ſtill remains much Country, which, it may be, will never be made ſerviceable.

What is the perpendicular height of this Mountain, I cannot learn. It cannot perhaps be rightly taken, being ſo ſubject to alter its Height and Shape. But it is a very goodly Mountain to look upon, as one paſſes by Sea to the Eaſtward, ſtanding alone by it ſelf, riſing from the very Shore; and at ſhorteſt Paſſage is reckoned Twenty Miles up to the Top, though from *Catania* it hath Thirty Miles as before.

n.52.p.1041 A good Quantity of *Aſhes* being taken up in divers parts of and about *Ætna*; ſome at the Top, or the Mouth of the new made Mountain, ſome a Mile off, ſome Four, ſome Ten Miles; ſome but half a Mile diſtant, and others on the Skirts of the ſaid Mountain; the Four firſt were found very dry like Duſt; but the two latter being very moiſt, though in *Sicily* (as we are inform'd) they have lain a good while expoſed to the Heat of the Sun; beſides that, the two laſt differ from one another, in that one ſort of them conſiſts of hard and ſmall Lumps, the other of very ſoft dirty Grains; yet both moiſt and of a vitriolate Taſte.

Some of the *Sciarri* are courſer, taken up at ſome Diſtance from the Mouth; and of theſe ſome black, with a Cruſt of *Brimſtone*, ſome of a red Hew, others are finer, and ſaid to be got out of the Gutters of Fire at the very Mouth. Both theſe kinds are light; but then there is a third ſort of Stone, very ſolid and ponderous, which ſeems to be made up of a Conflux of divers Minerals melted together.

The Fire ſpread about three Miles in Breadth, and ſeventeen Miles in Length.

An Account of ſeveral Burning Mountains in the Molucca Iſlands, *ſent to* M. Nich. Witſen, by . . . n. 216. p. 49.

XIII. 1. When the Eaſterly Wind had blown about 6 or 7 Weeks, till as I gueſs about the Fourth of *June*, 1693. The Mountain in the Iſland *Sorca* began early in the Morning, about Day-break, to caſt out more Fire than ordinary, which continued for 5 or 6 Days, during which it was dark and cloudy Weather, till at laſt it brought forth not only a moſt prodigious Flame, but alſo ſuch a black and ſulphurous Vapour, that the Inhabitants of *Hiſlo* (being a Village in the weſtern part of the Iſland, and neareſt to the Opening of the Mountain) were wholly covered by it; and afterwards followed a whole Stream of burning Brimſtone, which conſumed many that could not eſcape. Afterward the Inhabitants perceived that a part of the ſaid Mountain was ſunk down, and three or four Days after another part; and ſo from time to time, until the burning Lake was become almoſt as great as half of the Iſland: Wherefore the Inhabitants went on board of their Veſſels and Boats, from whence they perceived that huge great pieces of the Mountain fell into this fiery Lake, as into a Bottomleſs Pit, with a moſt prodigious Noiſe, as if a whole Cannon were diſcharged. But the moſt remarkable thing was, that the more vehement the Fire was, the leſſer the Iſland was ſhaken. The Inhabitants of another Town called *Woroc*, upon the Eaſt-ſide of the Iſland, not thinking themſelves in ſo great Danger, (the Opening, or Fiery Lake being yet at ſome diſtance, remained a Month longer, until they ſaw the ſame continually approaching them. They obſerved that when great pieces fell down, and that the Lake became wider, the Noiſe was ſo much the greater. So that they ſaw no likelihood but that all the Iſland would be ſwallowed up. Wherefore they unanimouſly tranſported themſelves to *Banda*, leaving all their Moveables for want of Veſſels, and arrived at *Amboyna* this 18th of *July* 1693.

Several Burning Mountains have now been filled up and quenched; others have begun to open themſelves, and caſt out Fire, as in the Iſle *Chiaus*.

There is likewiſe a Burning Mounta upon the Iſland *Celebes*. And in an infinite Number of Places, there is hot Water found, if you dig but 10 Foot deep.

In the Mountains of *Ternata* is always heard a terrible Noiſe, as of the Crying of a great many People, cauſed by the Fire. If often caſteth out Stones, and is probably exceeding deep : And the rather, becauſe it is likely that the ſeveral Burning Mountains of the *Molucca* Iſlands, are beneath conſumed by the ſame Fire, which joyneth the ſpacious Openings together.

The burning Mountain upon *Banda*, caſteth forth a prodigious Quantity of Smoak and Aſhes, oftentimes much Fire; and makes a Noiſe as if a great many of the greateſt Cannon were heard all at once. This Mountain hath caſt out ſo many Stones (and ſome near 6 Foot long) that the adjacent Sea, which has been 40 or 50 Fathom deep, is not only fill'd up there, but become many Fathoms higher than the Water ; whereby it may be conjectured how large the inward Cavities of this Mountain are.

By . . . n 216. p. 42.

2. After ſeveral vain Attempts to ſearch and examine the Conſtitution of the Opening of the burning Mountain in the Iſle of *Ternata*, at laſt having paſſed thro' great Difficulties, and mounted very dangerous Precipices, we arriv'd at the top *Octob.* 12. 1693. when I firſt approach'd this terrible *Fire-vomiting Opening*, wherein there is an inexpreſſible Noiſe, I could ſee nothing of the inward Parts, by Reaſon of the Smoak : Wherefore I went back a little, tarrying for a better Opportunity. After ſome time, I found the Smoak very much diminiſh'd, and making Haſte to the Mouth of it, I ſaw the Opening which is underneath the North-ſide, from whence the Cavity extended it ſelf towards the South, till the Edges on both ſides came to terminate at the North-ſide of that which was fallen in. Wherefore we went towards the Eaſt-ſide, to look into the weſtern Cavity, but we ſaw nothing but a fiery and flaming Subſtance, and the Conveyances of it. We did not venture to go to the North ſide, to ſee into the South Cavities, not only becauſe of the Southerly Wind, but alſo becauſe 'tis like, that the moſt ſpacious *Antra* are on the South-ſide, which cauſeth the Smoak to be driven Northerly, and becauſe we had formerly met with pieces of burning matter, that was caſt out towards the North-ſide. Having ſeen enough and ſatisfy'd my Curioſity, we withdrew and returned to *Malayen*, bringing with us ſome pieces of Branches of the fruitful *Clove trees* that we had paſſed by.

The Northerly-ſide of this burning Hole, is at the utmoſt height of the Mountain to the Northward, or from *Hori*. To the Weſt and Eaſtward of it there is on each ſide a *Hill* higher than the *Brinks* of this *Hole*, both of them grown over with *Reed* or *Cane*, by the Inhabitants call'd *Cannacanna* : The moſt weſterly, is ſituated more Northerly from the *Hole*, on the *South ſide* of this we got up. The moſt eaſterly, on the contrary part, lieth more backwards from it, and to the Southward of it. The Southerly Hill on the Weſt ſide of the *Mountain* turns about to the Eaſtward with a Riff or Ridge, and terminates at the North-ſide of the *Mountain* The *Mouth* of this fearful Hole on the Weſt and South-Eaſt ſides is ſurrounded, as by a Bank ; each Bank having a ſeveral *Ditch*, and the Brink of the *Mouth* is upon the higheſt part deſcending on the Out-ſide. The three Hillets neareſt to the Hole, are quite barren, and nothing but Stone, but the moſt remote is covered with thick *Reeds*.

Round about the *Hole* lies ſcatter'd much of the Matter that hath been caſt forth; and it is perceivable, that it muſt be ſoft when it comes out becauſe it falls flat, according to the Figure of the place where it falls. The *Colour* of it is dark green, not clear but ſomewhat gray; and this Matter generally does burſt or ſeparate it ſelf as the Dung of a *Cow*. There are of this both great and ſmall pieces now turned into Stone, being inwardly blackiſh and ſpongeous, mixt with white Spots. And to give you ſome further Particulars of this Burning Mountain, I have obſerved that the extreameſt or moſt ſoutherly round Bank is all covered with *Camacamia*; and it is the higheſt alſo. The *Smoak*, which in reſpect of *Malayen*, ſeem'd to come forth out of a higher Place, now in the deſcending of the Mountain, doth notwithſtanding ſeem to come forth at the ſame Height.

There is a *barren Hill* that ſeems to be ſituated on the North-ſide of the *Top* a little deſcending towards *Malayen*, but it is about the ſame Height as the higheſt Top that is ſeen from *Malayen*. Furthermore the Reaſon why the *Smoak* ſeems to come forth from a higher place, is becauſe the *Opening* is more ſoutherly, and then in regard of *Malayen*, only it ſeems that the *Smoak* comes forth more towards the Midſt. Wherefore I do certainly believe, that the right *Opening* formerly has been where the round Banks now lie, that is, to the ſouthward: For whereas after a good ſpace of violent Burning there groweth a ſmall Bank; any Perſon that ſhould ſee the Situation, would be of my Mind. And beſides it being 9 or 10 Years ſince the laſt burning was perceived, there are to be ſeen round about the Opening, (beſides the Barrenneſs on both ſides, which is ſome diſtance from the Opening in deſcending towards the Weſt and North Sides, as alſo above on the South and Eaſt ſides) Trees all about, of an unequal Thickneſs, as all grown ſince that time, and now newly burſt and burnt by the Fire.

Laſtly, My Opinion is, that altho' the Smoak of it has not been ſeen from below, the Fire nevertheleſs hath not diſcontinued, becauſe the *inward Noiſe* is ſo terrible, that any Perſon whoſoever hears it, will judge with me, that it is a *Bottomleſs Pit* of the *vehementeſt Fire*, which cannot be quenched while the World laſts. The Horror and Danger that one undergoes who will ſee this, is rather to be conceived by Thoughts, than expreſſed by Words.

3. *Nov.* 2. 1694. A very thick *Smoak* was ſeen about the top of the *Mount Gownong Apy*, which was much augmented on the 21 and 22, and that night the *Flame* broke out: On the 23, 24 and ſome following days, the *Fire* was continually increaſing on the Weſt ſide, and with ſuch Blows, as if the greateſt Pieces of Cannon had been diſcharged: So that we were fearing that the whole *Mountain* ſhould have been caſt upon us. A Day of *Humiliation* and *Prayer*, was proclaimed by the *Government* againſt the 7*th* throughout all *Banda*. Sometimes the *Mount* brought forth ſuch a *Noiſe*, as the greateſt Storms can do about the rigging of a Ship, or a Building on Shore, and afterwards followed *Stones* on the *Weſt-ſide* as far as the Sea, which was a hor-

[illegible] n. 228. p. 530.

rible Spectacle. Fiſhermen have related to me, that ſo many Stones have been caſt out already, that the Place where they uſed to Fiſh with Lines at 40 Fathom Water is now Dry, and the Fire cometh out of the Water ſo vehemently, that it is dreadful to ſee, and the Water is ſo Hot that we cannot come near it. And now the Mountain Burneth moſt towards the ſide of the *Loutoir*. The Trees on the Eaſt and Weſt ſide are altogether ſpoil'd, and the Weſt ſide is covered with Stones God knoweth how high. The Stink of *Brimſtone* during the Weſterly *Monſoon* is ſo intolerable, that one could ſcarce endure it in the Streets of *Neira* where it cauſeth a great Sickneſs The Water which runneth down, is, by Reaſon of the *Brimſtone* and *Salt Petre*, become ſour, and without a Natural Taſte. The Gardens which were on the *Gownong Apy*, and formerly brought forth great ſtore of Fruits for Man's Livelihood, are partly covered with Stones, and partly Deſert. The greateſt fear is becauſe it is *Conſum'd Inwardly* towards the *Old Hole*, which was Blown-up in the Year 1615, and becauſe the Fire ſeemeth to take its Courſe towards the South-weſt, and that it being quite Hollow there, will Tumble inwardly, or be Subverted.

By . . . ib. p. 531. 4. The Mount *Gownong Apy* caſteth out Stones round about the Mountain, and the Fire Aſcendeth ſo high, that we can ſee it above the High-land at *Danter*.

By . . . ib. p. 532. 5. Mount *Gownong Apy* (Burning continually) doth caſt out ſo great a Quantity of Fire and Aſhes, that the *Trees* of the Country *Neira*, and part of thoſe on the High Country of *Loutoir*, is ſo much covered with Aſhes, that not one good *Fruit* is to be expected from them.

By . . . ib. 6. At *Neira* there is neither *Leaf* nor *Herb*. The Ground is cover'd with *Stones* and *Aſhes*; one half of the High Country is likewiſe in a ſad Condition, many *Trees* be wholely or partly *Dead*, and the reſt *Lingring*. There is not one Houſe at *Neira* without Damage, ſeveral are quite Demoliſhed to the Ground by the Weight of the *Duſt* and *Aſhes*.

Thoſe of *Danter*, *Weyer*, *Celam*, and the inward Coaſt, as far as *Walking*, have likewiſe a ſad Experience of this Calamity. We are ſometimes viſited with *Earthquakes*; and eſpecially *May* 11th. 1695. about 2 a Clock in the Afternoon, we had two hard *Motions*.

By M. Nich. Witzer, n. 223. p. 529. 7. The Mountain *Kemas* or Brothers, in the Territory of *Manado*, is blown up with a moſt *Dreadful Noiſe*, as of the hardeſt Thunder, which cauſed *Darkneſs* and an *Earthquake*, with very Heavy Blows, and other Diſmal Signs at *Ternata*: Which Noiſe hath alſo been heard at *Amboyna*. The *Mountain* of *Brimſtone* upon *Amboyna*, call'd *Wawany*, does alſo *Burn Dreadfully*.

From all which it ſeemeth Evident that in thoſe Parts and Seas, there are *Subterraneous Fires*, having a mutual *Communication* one with another: Which God knoweth but may, at ſome time cauſe the ſudden *Subverſion* of them, and conſequently a Notable Change or Alteration of the World's Globe. Thoſe who have ſeen theſe things with their own Eyes have told me, that when a Hole is made in the Gound 10 or 12 Foot deep, the Ground is Warm.

XIV. 1. On

An Earthquake near Oxford. 1665. By Dr. Wallis. n. 10 p. 166.

XIV. 1. On the 19*th* of *Jan.* $166\frac{5}{6}$ at divers places near *Oxford*, was obſerved a ſmall *Earthquake* towards Evening. In *Oxford* it ſelf, I do not hear that it was obſerved to be an *Earthquake*; yet I remember about that time (whether preciſely then or not I cannot ſay) I took notice of ſome kind of Odd Shaking or Heaving, I obſerved in my Study, but did impute it to the going of Carts or Coaches, ſuppoſed to be not far off; though yet I did take notice of it, as a little differing from what is uſual on ſuch Occaſions; and wondred the more that I did not here any: But not knowing, what elſe to refer it to, I thought no more of it. And the like Account I have had from ſome others in *Oxford*, who yet did not think of an *Earthquake*; it being a rare thing with us.

I find my Notes, concerning my *Thermoſcope* and *Baroſcope* for that Day to be theſe.

$166\frac{5}{6}$. Day	*January.* Hour	*Thermo.* *Inches.*	*Baroſc.* *Inches.*	*Weather.*	
19.	8. *Morn*	$14\frac{1}{16}$	$29\frac{1}{2}$	Hard Froſt.	Cloſe.
	4. *Even*	$14\frac{3}{8}$	$29\frac{1}{3}$	Hard Froſt.	Cloudy
	9. *Even*	$14\frac{3}{4}$	$29\frac{1}{4}$	Rain.	Wind
20.	8. *Morn*	$15\frac{1}{4}$	$28\frac{3}{4}$	Sunſhine	Wind

I hear, it was obſerved at *Blechington*, above 5 Miles to the North of *Oxford*, and ſo along by *Boſtol*, *Horton*, *Stanton St. Johns*, and ſo towards *Whately*, which is about 4 Miles Eaſtward from *Oxford*. Not at all theſe Places at the ſame time, but moving forwards from *Blechington* towards *Whately*. For it was at *Stanton* about 6 of the Clock, or later (as I underſtood from Mr. *Boyle*, who was there at that time) but had been at *Blechington* a good while ſooner. And I am told that it was taken notice of by Dr. *Holder* (a Member of our Society) who was then at *Blechington*, to be obſerved by thoſe in the further part of the Garden, ſome very diſcernable time before it was obſerved by thoſe in the Houſe; creeping forward from the one place to the other.

By Mr. Rob. Boyle. n. 11. p. 179.

2. Riding ſomewhat late betwixt *Oxford* and a Lodging I have at a place 4 Miles diſtant from it I found the Cold very piercing, which put me upon Galloping at no very lazy rate; and yet before I could get to my Lodgings, I found the Wind turned, and felt the Rain falling. This Accident, conſidering the ſhortneſs of the time, and that it was preceded by a ſettled *Froſt*, was ſurpriſing to me, being one of the greateſt and ſuddaineſt Alterations of the Air, I had ever obſerved. Soon after (by my Gueſs about an Hour) there was a manifeſt Trembling in the Houſe where I was (which ſtands high in Compariſon of *Oxford*: But it was not there ſo great, that I ſhould have taken any notice of it as an *Earthquake*, if I had not been Advertiſed of it as being taken Notice of by the People of the Houſe. Soon after there hap-

pened a Briſk Storm: Whereupon I ſent to make Inquiry at a place called *Brill*, which ſtanding upon a much higher Ground, I ſuppoſed might be more Obnoxious to the Effects of the *Earthquake*. The Perſon I ſent to, writ me a Ticket, whoſe Subſtance was, That the *Earthquake* there was much more conſiderable, than where I lodged, and that a Gentleman's Houſe in the Neighbourhood Trembled very much, ſo as to make the Stones manifeſtly to Move to and fro in the Parlour, to the great Amazement and Fright of all the Family. The Hill whereon this *Brill* ſtands, I have obſerved to be very well ſtored with *Mineral* Subſtances of ſeveral kinds. I have been informed by others, that this *Earthquake* reached a good many Miles.

By Dr. J. Beale. n. 116 p. 357.

3. I conceive the *Subterraneous Steams* might be the Cauſe of ſuch a *Midland Earthquake*. And I know no ſurer or better way to find out the Nature and Properties of thoſe Steams, than by obſerving the Effects, and all the Alterations of the Air, as Mr. *Boyle* and Dr. *Wallis* have done.

An Earthquake at Oxford. 1683. *By* Mr. Tho. Pigott. n. 151. p. 311.

XV. *Sept.* 17. 1683. An *Earthquake* happened here at *Oxford*. The Rarety of ſuch Effects make many People not know what they are; and by heightning their Surpriſe, impoſes upon their Judgments One fanſied it to be the falling of ſomething about his Houſe; another the tumbling of Wood; a third the Ratling of a Cart; one one thing, and one another, till either a mature Deliberation, or Intelligence from other Hands, convinced them to the contrary; and ſatisfy'd them it was an *Earthquake*. Beſides, the ſhort continuance of the Trembling, would hardly permit them to make any Accurate Obſervation.

I, for my part, perceived the *Sound* and *Motion* very plainly, and though when I ſaw the Clearneſs of the Morning, I judged that to be an *Earthquake*, which otherwiſe I might have thought to have been only a diſtant Thunder, yet had I not ſo clear an Impreſſion of it in my Mind as to make any Conſiderable Obſervations of my own: So that what I can afford you, will be only ſome Occaſional Reflections upon *Earthquakes* in general, and Remarks upon the Intelligence, which I have picked up here and there concerning this in particular.

1. This *Earthquake* happened at a time in which ſuch Effects are commonly Experienced, if we may credit *Ariſtotle*, who tells us that they are moſt frequently, tho' not always in *Spring* and *Autumn*; in which there is generally a greater Abundance of *Moiſture* ſucked up, more *Vapours*, and a larger quantity of *Nitre* (as Experience doth Demonſtrate) all which Ingredients may conſpire to the producing of an *Earthquake*. For if we conſider how capable they are of a large *Expanſion*, how forcible they are when Rarefy'd in Veſſels cloſed and placed over the Fire; in *Æolipyles*, from which they break out with forcible Blaſts, or in Winds, which frequently proceed from the *Rarefaction* of ſuch Principles, we may ſuppoſe that thoſe *Vapours* which produce ſuch great Commotions in the Air, may cauſe a conſiderable Diſturbance in the *Earth*, when pent and locked up by Cold, or any ſuch like Accident.

2. The latter part of the firſt Week in *September* was ſo Rainy, that moſt People were apprehenſive of a Flood, and upon *Sunday* the 9th of *September*, there fell ſome very conſiderable Showers in the Afternoon; but from that time it cleared up, and to the End of the next Week continued very Warm and Pleaſant Weather. The Evening of *Sunday* the 16th, was inclinable to Froſt, and the next Morning it was found to be a very hard Froſt, for the Seaſon, and then about Seven of the Clock, the Day being very Clear and Calm, the *Earthquake* happen'd. The like Obſervations of Cold preceding that of 166$\frac{5}{6}$ were made by Dr. *Wallis* and Mr *Boyle*.

3. The Quick-ſilver in the *Barometer* (as I am told by the Operator in *Chymiſtry* here) ſtood as high then, as at any time theſe Three Years; which together with a remarkable Calmneſs of the Air, a matter generally looked upon as one of the Circumſtances which accompany *Earthquakes*, and by many reckon'd amongſt the Signs which fore-run them, may be ſufficient to ſhew how free the Air was from Vapours at that time; and ſurely the fewer there were above, the more may be ſuppoſed below.

4. *Ignes Fatui* were frequently ſeen a few Days before this *Earthquake* happen'd; which may paſs for a Probable Argument, at leaſt, to ſhew how full the *Earth* was then of *Damps* and *Exhalations*, ſince a *Stench* that hath Tainted Well-Water after an unuſual manner, hath upon the ſame Account been generally Reckon'd amongſt the Signs of an *Earthquake*, by which it may be Predicted: For by this it was that *Pherecydes* is ſaid to have Preſaged the *Earthquake* of *Lacedamon*, and *Helmont* mentions another who pretended to the ſame Fore-ſight, by Taſting the Water of a very deep Well in the Caſtle of *Lovain*.

5. The Motion of this *Earthquake* was not of that ſort, which are termed *Pulſes* or *Succuſſions*; ſuch as ſtrike the Ground at Right Angles with a Violent Shock, or intermittent Knocking, ſo as oftentimes to raiſe the *Earth* to a conſiderable height, or force their way by a Breach; but it appear'd rather to be ſuch a Trembling Motion as Vibrates and Shakes without Altering the Poſition of the *Earth*, and leaves all things in the ſame Poſture in which it found them. For it Shook the *Earth* with a *Tremulous* and *Vibrating Motion*, whoſe Reciprocations were repeated with a great deal of Quickneſs. The *Pulſes* were, as I could perceive, a little diſcontinued, and yet they came ſo thick that I could not Count them, tho' the whole *Earthquake* continued here, ſcarce more than *6 2ds* of Time; and when that ended the *Motus Reſtitutionis*, or ſettling of the Building in which I was, did ſeem to be with a Craſh.

6. Now as *Tremulous* and *Vibrating Motions* are proper to produce Sounds, ſo was this *Earthquake* accompanied with a *Hollow Murmuring* Sound, like diſtant Thunder, as I have obſerved before, which Sound kept time ſo exactly with the Motion, and was ſo conformable to it in all Reſpects, that it plainly appears there was the ſame Reaſon for both. To thoſe that were within Doors it appear'd to be more conſiderable, and as it were in the Air above, occaſioned chiefly by the Shaking of the Building; as we may gueſs by a Blow or a Stamp in a Room, which beſides the Principal Sound from

the part that is Stricken, cauſes another Obſcure one, together with a Small Shaking throughout the whole; and in the *Laboratory* it was heard more Loud: For all Sounds have a great Advantage there. But thoſe who were Abroad in the Fields and open Air, preceived with a gentle Shaking, a Hollow Murmur towards the Surface of the *Earth*, not unfitly compared to the Groaning of ſome Planks of Elm, Aſh or Firr, when the Application of Fire cauſes both a Trembling and Sound. That there is a conſiderable Heat within the *Earth* is manifeſt, from the Experience of Mines working in the deeper Grooves; from thoſe Hot-Springs which break out thence; from Fermentations occaſioned by Mineral Spitits. Nor is it leſs commonly obſerved, that ſuch *Heats* and *Fermentations* within the *Earth* are Augmented by Froſty *Weather*, when the Steams being more Pent up and hindred from breaking out, do Work more forcibly upon one another. And that Sounds and Tremblings may be produced by ſuch *Heat*, though it did but work upon *Air*, *Watery Vapours*, or *Nitre*, only included in Pores and Cavities, appears by ſeveral Experiments; as that of filling Glaſs-bubbles half full with *Water* and *Nitre*, which being ſet to the *Heat* of the Fire will Tremble with a ſort of Humming Sound, and after that Break with a great deal of Noiſe and Violence.

7. This Sound as well as Trembling appears to have been the ſame in moſt of thoſe places where they were perceived; from whence we may infer, that they were not cauſed by the falling of the *Earth* or *Rock* from the upper part of ſome Cavern; nor from any Commotion of Vapours within the Hollows, as Powder Works in a Mine, by which Similitudes it is uſual to expound ſome *Earthquakes*: For then it would have been perceived more plainly in places above it, or thoſe that were near adjoining, and not equally conſiderable in Towns of ſuch various diſtances, as *Oxford*, *Burford*, *Watlington*, *Benſon*; *Brill*, and *Ailsbury* in *Bucks*; *Wallingford*, *Radley*, *Appleton*, and ſome other places in *Barkſhire*; with many more round about.

8. Yet I cannot but ſay that it was leſs conſiderable in ſome places than in others: The Men of ſome *Towns* ſpeak dubiouſly, eſpecially towards the North of *Oxford*; and ſome talk of a Neighbouring *Town* feeling it, tho' their own did not. Yea even here in *Town* the *Earthquake* was not perceived ſo plainly in ſome places as in others; but that may depend upon Circumſtances, as the Poſition and Form of the Houſes, or ſome Accidents, as Noiſe of Carts intervening, which might render it leſs obſervable. Beſides, I do not deny but there may be ſome *Cuniculi*, little Paſſages or Hollows here and there under ground, which might advantage the Trembling, and elſewhere more ſolid parts which might Damp and Obſtruct it.

9. This might occaſion ſome Difference in the Sound too. One perceived it like a Voice under ground, but he could not tell which Way it paſſed, perhaps there might be a Cavern there. Another who was travelling over *Shotover* heard the ſame; and it is very likely that there are conſiderable Hollows there. One who was Fiſhing in the *Charwel* informs me, that whilſt his Boat trembled under him, and the leſſer Fiſhes ſeemed much affrighted

frighted by an unuſual Skipping, he heard the Murmur as of a Riſing Wind, Which he fanſied juſt then Breaking out, and Rumbling upwards but felt none. The like relation, as to Rumbling in the Air, I have from good hands concerning ſome People that were in *Dourton-park* in *Buckinghamſhire*; which I mention only for the Diſtance ſake: For moſt hereabouts Agree in the ſame Fancy. I my ſelf Heard it like a Diſtant Thunder, a Noiſe determined to one Place, not Fleeting or Paſſing from me, tho' the Craſh which ended the Shaking of the building, little deceived me in my firſt Imaginations.

Ariſtotle (*de Mundo*) calls the *Earthquakes* of this kind, by the name of Βράσται as if they boyled, becauſe they Ply up and down. And I take this that happened here, to be no ſuch Forcible, or Irregular Ebullition raiſing the *Earth* with intermitting Shocks, as that of *Mechlin* for Inſtance *Apr.* 4, 1640 deſcribed by *Van Helmont*: But a Regular *Efferveſcence* of incloſed Vapours, more evenly diſperſed, working up and down the *Earth* with a Trembling of each Part, and a Reciprocal Agitation of the Whole. For I could never meet with any, who pretended to Determine from what this *Earthquake* Came, or whither it Went.

10. All who felt this *Earthquake*, ſay it happened about 7 a Clock: But I dare make no Inference from hence, that the Shaking really was in all Places at the ſame time, unleſs the time had been exactly obſerved, to a Minute at leaſt, in ſeveral Places. For ſince all *Tremours* and *Sounds* are found to move above 15 Miles in a Minute, and above 94 in an hour, and conſequently the Trembling of the *Earth* paſſing along with a continued *Noiſe*, may be ſuppoſed as Quick in it's Motion. It might according to this *Calculation* in a Minutes time have reached the Extremity of its Sphere or Compaſs: For the Circuit of this *Earthquake*, was but 70 Miles, or thereabouts; it s Largeſt Extent was from South-Eaſt to North-Weſt, the leaſt from *N.* to *S.* For it was perceived a little ſhort of *Kirklington N.* of *Oxford*, at *Blechington* and at *Alysbury*, *S. E.* where it was perceived plainly; as alſo at *Thame* which is *E.* and ſo at *Aſton*, *Kingſton* and *Stoken-Church-Hill*; at *Watlington S. E.* (ſome ſay at *Reading* which is more *S.* and then its compaſs may be ſuppoſed larger) at *Wallingford S. E. b. S.* as much as any place; at *Abington South*, but not much; not ſo far as *Farington S. W.* but at *Bampton W.* at *Burford* to the North, at *Lo. Harborough N. W.* not much: at *Woodſtock* which is more *N.* little or none; and at *Glympton* 2 Miles beyond it, not at all, as I am informed. But this is a very inconſiderable Space, if compared with that which happened in the Southern Parts of *Norway Apr.* 24. 1657. and took up 160 Miles in Length and ſo much in Breadth, ſaith *Michael Peterſon Eſcholt*, that deſcribes it; And *Kircher* mentions one 200 Miles in Length.

11. The Effects too of this *Earthquake* were very inconſiderable, as Shaking down ſome *Pewter* in a very few Places; caſting out a Truckle bed *Weſtward*, which when looked upon I found ſo very eaſie to move and apt to Run, as alſo the Room ſo Smooth and Declining towards that Point, that I could as little Infer from thence that the Motion came this or that Way, as from the falling of many Books from the Northſide of a Ware-

houſe when a few only fell from the South. And of whatever Nature the Encloſed Vapours were, which cauſed this *Earthquake*, it ſeems as if they were not able to Force their Paſſage through the *Earth* (at leaſt but Slowly:) For the Air till the End of the Week continued Fair, tho' the Week enſuing was very Windy and Boyſterous.

12. We have *Earthquakes* here very Seldom; not one before for almoſt a ſcore of Years except that which is doubtfully reported to have happened about 4 a Clock in the ſame Morning. But ſeeing the *Earth* abounds with ſuch great Variety of Matter, which may Produce them, as alſo with ſo many Caverns and Chinks of ſuch various Figures, through which they may be Agitated with ſuch different Motions, it ſeems more eaſie to ſhew how they may begin, how they may be carried on, how they may produce ſuch different Effects, and how they may continue; than to determine why they ſhould happen ſo Rarely, do no more Miſchief, or be ſtopped ſo ſoon in their Motion.

An Earthquake *in the* Midland-Counties. 1683. *By Mr.* Tho. Pigot. n 151. p. 32I

XVI. There was another *Earthquake* far more conſiderable, which happened *Oct.* 9. about 11 at Night: And was in *Oxfordſhire* Northwards very much; ſome ſay they felt it here at *Oxford.* It ſpread all over the *Midland Counties* and extended into *Darbyſhire:* In which, as in the Coal-Countrys, it was very Violent. They Report that it was in all its ſeveral places at the ſame Time, not determining preciſely: And that it Produced ſome Remarkable Effects.

An Earthquake *in* Sicily. 1692 3. *By* Mr. Martin Hartop. n. 202. p. 827

XVII. 1. It ſeems highly probable that theſe Tremblings of the *Earth* proceed from the ſame Incens'd matter, which finding a way at other times through the *Mongibello,* has ſo furiouſly broken out in Smoak and Fire. This appears by the Tragedy of *Catania.*

The *Eruptions* of theſe *Mountains* are of two ſorts; the one not ſo very Violent as to diſturb much the Adjacent Country, and this happens once in 2 or 3 Months, and laſts 3 or 4 Days. The other is more Furious and of longer continuance, and is obſerved here at *Naples* to happen to Mount *Veſuvio* once in about 80 Years, as I heard the Ingenious Mr. *Peccacio* ſay. Of theſe the laſt in 1632. was ſo very Violent, that by the beſt of his Obſervation it caſt the Rocks 3 Miles into the Air. Now from the Burning or not Burning of this Hill, *Naples* (and without doubt the ſame holds in *Sicily*) Calculates its Safety or Danger of *Earthquakes.* For without doubt the Matter is continually Burning under the Mountain; and thoſe vaſt Clouds of Smoak which daily iſſue out of the top, if the Cavity happen, by any Rock or inward Alteration, to be ſtopt, muſt deviate through other Paſſages under ground, heaping up continually Magazines for a Future Calamity. Now this Combuſtible matter ſeems to me to be nothing but *Nitre* mixt with ſome other *Minerals* and *Sulphur.* He that has ſeen the way of making *Salt* of *Tartar* by *Deflagrations,* where you mix an equal quantity of Pulveriz'd *Nitre,* has ſeen an exact Type of theſe Burning Hills, for after each Spoonfull you put into the Burning Crucible, ariſes firſt a black thick

Smoak, after which the Fired Mineral boils up, as if it would over run the top of the Crucible.

The Motion of the *Earth* is not from the *Perpendicular*, but *Horizontal*; as appears by the Cracks in the *Earth*, which they ſay, are to be found now all over *Sicily*: 'Tis a Vibration ſo quick, that it Cracks the Glaſs in the Windows; 'tis Diſputable whether the *Reciprocations* of a Lute String are more frequent. Now when the *Vibrations* are ſo quick, and the Body moved ſo great, the Motion muſt be prodigiouſly Violent. We obſerve that Thunder which is the Effect of the Trembling of the Air, cauſed by the ſame Vapurs diſperſed through it encountring one the other, has force enough to Shake our Houſes. And why there mayn't be Lightning and Thunder under Ground, in ſome vaſt Repoſitories there, I ſee no Reaſon; eſpecially, if we Reflect, that the matter which compoſes the Noiſie Vapour above us, is in much larger Quantities to be found under Ground. I can attribute this *Horizontal Trembling* to nothing elſe but the furious Paſſage of the Incenſed Matter from one Grotto to another: For 'tis very Probable theſe are continued, in ſome Parts of the *Earth*, for ſeveral Leagues together; Witneſs your laſt *Earthquake* about 4 or 5 Years ago, which was felt, (with little difference as to Time) in *England* and *Ireland*. Another Confirmation of this is, the manner how theſe Trembling Fits are performed; which is not all of a ſudden, like that of *Gun-powder* in a *Mine*, but is ſmall at firſt, afterwards gradually more Terrible, like a growing *Tempeſt*. A Third may be, the Obſervation of ſome here in *Naples*, that when Mount *Veſuvio* ceaſes to Burn, the *Sulfaterra* ſends out it's Fumes more violently, *& vice verſa*. Now this *Sulfaterra* is a Hill near *Puzzolo* as diſtant from *Naples* on the one hand, as the Hill *Veſuvio* is on the other; ſo that 'tis more than probable that *Naples* ſtands upon a Burning Arch, through which, as a Pipe, there two furious Neighbours do reciprocally receive the above ſaid *Exalation*. This ſeems to me a Growing Evil to this Wealthy and Populous City. And what may poſſibly make good the Prediction of *Sanazarius*, who was Born here.

Et te, quis putet hæc? Altrix mea durus Arator
Vertet: et Urbs, dicet, hæc quoque Clara fuit.

2. The Iſland of *Sicilia*, of 700 Miles Circuit, and divided into 3 Valleys, began on *Friday* the 19th of *January* 1693. about half an hour paſt 4 a Clock, to be Senſible of the Shake in the Valley of *Mazara*: But in the Two other Valleys of *Emone* and *Noto*, the *Shakes* were ſo Terrible, as to throw down ſome Buildings, obliging the Inhabitants to ſeek Refuge either in the Fields, or with Prayers and Tears implore the Divine Pity in the Churches. On *Sunday* following, being the 11th of the ſame Month, at 20 hours and 3 quarters, the Hand of God appeared much more Terrible, awakening the moſt Lethargick Sinner. The *Shakes* of this *Earthquake* did no damage in the Valley of *Mazara*, only Frighting the People.

By P. Aleſſandro Burgos, ib p. 83.

Palermo received ſome Detriment in moſt of the Buildings, eſpecially the

Palace and Hoſpital of St. *Bartholomews*, the Steeple of St. *Nicholas*, belonging to the *Auguſtines*, was Ruined and ſome Hurt done to the Church; but little Miſchief elſe done, and no Body Hurt.

In *Meſſina* all the Buildings of the *Theatre* are ſhattered, the Royal and Archbiſhop's *Palace*, with the Seminary, are all Crack'd. The Vaſt and ſtately Church of the *Franciſcans* broken in many places, and the Roof of the *Veſtry* fallen; the *Steeple* of the Church of the *Annunciation* thrown down with the Death of the *Sexton*; the Top of the *Spire* of the *Dome* Cleft. Many Private Buildings were thrown down, and all the reſt ſhored up. There were but few Perſons killed.

Traina, *Randazzo*, *Nicoſia*, Cities in the Mountains, ſuffered in their Buildings. The Firſt and half of the Mother Church Deſtroyed, with the Pariſh Church of St. *Lucy*, and was much damaged in his Monaſteries; one whereof is not Habitable. The laſt had it's *Dome* very much Hurt. *Caſtigleone* had the Caſtle and many Houſes thrown down; in *Franca villa* and *Linguagroſſa*, the greater part of the Buildings and ſome Churches; *Maſcali* quite Ruined, but not many Killed, moſt of the People being abroad at a Proceſſion with the Reliques of St. *Leonard* their Protector.

Aidone received a conſiderable Miſchief, two whole Quarters, with many of its Inhabitants, being deſtroyed. In the Quarter of St. *Laurence* there is not one Houſe ſtanding, and the Churches Ruined: In that of St. *James* the Church of the *Annunciation* and its *Oratory* thrown down, with ſeveral other Sarced Edifices. In the other part of the City, which ſtands lower, there were not ſo many Houſes nor Perſons loſt, yet the Church of Pope *Leo* is quite Flat; and the Magnificent Church of the *Dominicans* in Ruines, with the Convent of the *Reformati Oſſervanti*, one of the beſt in the whole Province.

Abi Aquilea, commonly called *Jaci Reale*, Situated at the foot of *Ætna*, is almoſt quite deſtroyed, and its Inhabitants Buried in the Ruines, with many Convents; amongſt the reſt the Famous one of the *Oſſervanti Reformati*.

Aci St. Antonio, *Aci St. Filippo*, *St. Gregorio*, *Pedara Trecaſtagni*, *Bonnacorsi*, *Nicoloſi*, *Motta*, *Meſterbianco*, *Fenicia*, and ſeveral other Fruitful Villages ſituated near *Mongibello*, are deſtroyed, with all the Habitations of Pleaſant Hills about *Cananea*, which are now in the Duſt.

Paterno, about 12 Miles from *Catania*, a Populous City at the foot of *Mongibello*, loſt moſt of its Buildings, all the Convents of Fryars, and a very fine Monaſtery. In the Ruines were Buried 40 Perſons. *Aderno*, had the ſame Fate.

Cantabiano Piemonte in the Valley of *Emona*, *Francofonte*, *Palagonia* in the Valley of *Noto*, are little leſs than wholly Level'd, and about 300 Perſons deſtroyed. The Marqueſs of *Francofonte*, was Miraculouſly ſaved by Leaping out through the Crack in the Wall of the falling Edifice.

Catania, one of the moſt Ancient and Famous Cities of the whole Kingdom; Honoured by the Courts of ſeveral Monarchs, and an Epiſcopal See even from the Time of the Apoſtles: Giving place to none in the Beauty of its Sacred Edifices, amongſt which the *Dome* was the moſt Sumptuous and

Large in all *Sicily*, Adorned with excellent Pictures, and richly furniſhed, and Bleſſed with the Reliques of the Invincible Martyr St *Agatha*, Honoured with the Bodies of ſeveral Kings; beſides it had a very high and curiouſly built *Steeple*. Here were a great many Nunneries; amongſt the reſt the Monaſtery of the *Trinity*, and that of St. *Benedict*, with that prodigy of Workmanſhip the Magnificent Monaſtery of St. *Nicholas*, with its Temple, a place Famous for ſeveral Reliques. Next the *Jeſuits* College, the Convent of the *Minorites*, and two of the *Dominicans*, the Beautiful one of *Capuchins*, the Imperial Convent of the *Carmelites*, that of the *Reformed Minorites*, that of the *Reformed Auguſtines*, with ſeveral other Friaries, with an infinite Number of the Ancient and Modern Churches, Colleges, and other publick Buildings, inhabited with 23000 Souls.

Its Nobility many and Ancient. Learning was here in its Glory; the Citizens were themſelves Learned, and Lovers of Knowledge, aſſiſted with the many Privileges granted by the King. The Univerſity where the Learned Laurel was conferred on the Worthy, made this place the *Sicilian Athens*. This once ſo Famous now Unhappy *Catania*, had the greateſt ſhare in this Tragedy. Father *Antonio Serrovita*, who was to Preach at *Catania* the Lent following, was on his Way thither on the 11*th* at 20 hours and ¼, and at the diſtance of a few Miles; He obſerved a black Cloud like Night hovering over the City; that there aroſe from the Mouth of *Mongibello* great Spires of *Flame*, which ſpread themſelves all round; that the Sea all of a ſudden began to Roar, and riſe it ſelf in Swelling Billows; that there was a very great and dreadful Blow, as if all the Artillery in the World had been at once Diſcharged; that the Birds flew about aſtoniſh'd in the Air; that the Beaſts and Cattle in the Fields ran crying about affrighted; that His and his Companions Horſes were ſo ſtartled, that they ſtood ſtock ſtill, Trembling ſo as that they were forced to alight, which they had no ſooner done, but they were lifted from the Ground above two *Palms*; and caſting his Eyes towards *Catania*, he with Amazement ſaw nothing but a very thick Cloud of Duſt in the Air. This was the Scene of their Calamity. For of the Magnificent *Catania* there is not the leaſt Footſtep to be ſeen. All its Edifices are Levelled with the Ground, except the Chappel of St. *Agatha*, the *Rotunda*, the Caſtle of *Urſino*, the Walls that encompaſſed it, and a few Mean Houſes. There was a very great Deſtruction of the Inhabitants buried in the Ruines of the Biſhop's Palace, the Steeple, and *Dome*, where moſt of the City, frightned with *Friday's Earthquake*, were got together to carry the Reliques of St. *Agatha* in Proceſſion. Many of the Nobility were ſaved under the Chappel of the Saint and ſome of the Clergy. The Number of the Dead was about 15000; for though the People had ſtaid in the Fields all the *Saturday*, yet the Solemnity obliged them to be in the City on the *Sunday* to pay their Devotions, at the Proceſſion. Of the *Benedictines* about 25 were Killed in the Quire, of the *Jeſuits* 21; of the *Conventuals* 11, the Number of the *Dominicans* is not known; the *Carmelites* were all Buried except one, as they went in Proceſſion; and ſo were the greater part of the other *Religious Orders*; and of the *Nuns* few were ſaved. This was the Tragedy of

Catania, which was accompanied with dreadful Lightnings and Thunder from Heaven, with Deluges of Rain; and in the Ruines were heard nothing but Cries, Scrieches, and Dying Groans. On the Heaps of Stones we may now Write, *Here was Catania.*

Lentini, a very Ancient City, Honoured with the Births of many Illuſtrious Perſons, amongſt the reſt, that Father of Eloquence, *Gregorio Leontino*, of a long time an Epiſcopal See, *&c.* felt that Shock on the *9th*, with ſuch violence, as threw down and Ruined the greater part of its Buildings; amongſt which was the Ancient Convent of *Minorites*, famous for being the Dwelling place of St. *Anthony* of *Padua*; the *Royal Convent*, ſo called from the Tomb of one of our Queens buried there; under the Ruines of which 4 Religious were Buried, the reſt eſcaped miraculouſly. But the laſt *Earthquake* on the *11th*, laid in the Duſt the Remainder of the City, with the Death of about 4000 People that returned thither after the firſt Shake, to take care of their Goods. So that now there is but the Carcaſe of a City all ſhatter'd to pieces, not one Houſe left ſtanding.

Carlentine, a Modern City, being as a Citadel dependent on *Lentine*, had the ſame Fate. The Beautiful Caſtle of *Licodia* all ruined, with the Marchioneſs of *Martini* and all her Children Buried therein.

Bizrini, a City of Rich Inhabitants, is Levelled with the Ground.

Sortino and *Ceſſero* are quite Demoliſhed; in the firſt, about 3000 Periſhed.

Agoſta, a Trading Town, built on an Iſland in a large Bay, which makes a capacious Port, was all blown up into the Air; for beſides the Damage of the *Earthquake* there was a great quantity of Powder in the Caſtle that took Fire, and killed ſeveral of the Citizens that had eſcaped into the Fields, with the Stones of the Buildings. Here periſhed about 3000. The Enraged Sea grew terrible Boiſterous, and Tempeſtuouſly beat againſt the Walls of the *Dominican Convent* with ſuch fury, that ſome Galleys belonging to the *Knights* of *Malta*, ſcarcely eſcaped Shipwrack in the Port. In fine,

Luctus ubique, Pavor, & plurima Mortis Imago.

The Country of *Mililli* in the Dutchy of *Montalto*, felt the ſame Fate, with the Deſtruction of the Inhabitants.

Syracuſa, famous in Old Time, an Epiſcopal See; in our time like the *Phœnix* ariſing from the Aſhes, ſtanding upon a *Peninſula*, by Art made an Iſland, having a Bridge to the Main Land; ſtrengthened with a Modern Fortification, ſufficiently Populous, by reaſon of its convenient ſituation for Trade, full of Nobility, and Beautify'd with Churches, Convents, Monaſteries, and Palaces, now Mourns in Ruines. It was ſenſible of *Fridays*, but Shook to pieces by the *Sunday's Earthquake*, with the loſs of many Thouſand Perſons. Moſt of the Nobility ſaved themſelves by a timely Flight. Of the Religious not many Periſhed. Scarce a Village in the whole Dioceſs is left; Confuſion Reigns every where; and the Miſery is encreaſed by want of Food, cauſed by the Granaries and Mills being Deſtroy'd.

Laſerla, *Palazzuolo*, and *Buſceni* lie in Ruines, with many Inhabitants deſtroy'd.

Spacaforno, a Populous Place ſituated near the Sea, which waſhes the foot of the Promontory *Pachino*, has loſt all its Buildings. Here they reckon about 2000 Dead.

Giarratana with its Fall killed moſt of the Inhabitants. The Marqueſs himſelf, with his Wife and 3 Children, eſcaping on *Friday*, were on *Sunday* Buried in the Ruines; the Marqueſs and his Children were taken out alive, to bewail the loſs of his Lady.

Melitello, in the Valley of *Noto*, is ſhaken to Pieces, the Churches and chief Buildings even with the Ground, and the Religious Orders all turned out into the open Air, or under Huts and Cabins.

Occhiula eſcaped not the common Calamity.

Mineo, an Ancient City, is now no more; and the greater part of the Citizens and Religious.

Caltagirone, a City conſpicuous for its Senate and Nobility, ſuffer'd in this Univerſal Calamity, the total Ruin of it Proud Edifices: As the Principal Church, with its very high Steeple or Spire, the famous College of St. *Julian*, the Temple of St. *George*, the Pariſh Church of St. *James*, Admired for the Pictures of *Epiphanius*, the Chappel only remaining, with the Image and Reliques of the Saint. The Temple of the *Conventuals* thrown down, the famous Bridge that joins the Convent to the Town ſhattered to pieces, and the Dormitories not to be Inhabited; the Famous Convent of St. *Bonaventure* the Fall of whoſe Temple and Spire was the Deſtruction of the Lower Buildings; the College of the *Jeſuits* and the Steeple of that Noble Church are quite Ruined. The *Carmelites*, *Dominicans*, *Auguſtines*, *Crouched Friars*, *&c.* are all without Churches and Convents. The Monaſteries of St *Gregory*, St. *Chiara*, St. *Salvator*, and St. *Stephen*, with a *Conſervatory* of *Orphans*, are all ſhook down. In fine, the Senate-Houſe, adorned with moſt Curious Statues, and all the other Buildings, are either Fallen, or threaten a ſudden Ruine. In theſe Deſolations, about 1000 People were loſt.

Modica, a Populous place, and a chief of the Seigniory of the *Admiral* of *Caſtile*, has its Buildings and famous Caſtle laid in the Duſt. Seignior Abbot *Frederick*, the *Procurator General*, ſaved himſelf in the College of the *Jeſuites*, from whom we have the Account; and that the Cities of *Raguſa*, *Sicily*, and *Chiaramonte*, had the ſame Misfortune.

Comiſo ſuffered much in its Buildings, though but few were killed. The Convent is down, but the Church ſtands.

Noto, an Ancient and Ingenious City, full of Nobility and fine Buildings, Convents and Monaſteries as we hear from a Courier from thence, is all Ruin'd; the Convents of the *Dominicans*, *Conventuals*, *Reformati*, *Carmelites*, and *Capuchins*, which was indeed a Wondrous Fabrick, are all torn to Pieces. The Church of the *Crucifixion*, the *Dome*, and all the Nunneries are down, with the Deaths of many Citizens and Nobles.

To conclude, there is not a Corner in all the Valley of *Noto*, that is not Ruined wholly, or for the moſt part, with a Dreadful Slaughter of the

People. The Southern Coaſts, as *Licati*, *Terra Nova*, and *Gircuti*, have ſuffered Damage in their Buildings. And all the Caſtles of the Valley of *Emone* near *Mongibello*, are cracked and broken or thrown down.

By the Noble Vincentius Bonajutus. n. 207. p. 2.

In Dec. 1. l. 1. Cap. 4. and Dec. ult. l. 10

3. The continual Fiery Eruptions of *Ætna* (of which the Firſt that we have any Account of, happened 500 Years before the Deſtruction of *Troy*, as *Diodorus Siculus* Relates) have been taken from the moſt likely Cauſes of the Horrible Shakes that from Time to Time have laid Waſte the Iſland of *Sicilia*; as is obſerved by *Fazello*, where he Remembers that of the Year 1542, which on the 10*th* of *December* at the 23d Hour, ſhook the whole Iſland, and eſpecially *Val di Nota*, *Syracuſa*. *Lentini*, *Sortini*, *Mililli*, *Catania*, *Agoſta*, *Noto*, *Caltagirone*, *Militello*; and in ſhort, the ſame Cities and Caſtles which were miſerably ruined by the Two late violent *Earthquakes* of this preſent Year 1693.

The Firſt of which was at 5 a Clock the next Night after the 9*th* of *January*. Its Motion was of that ſort which *Ariſtotle* and *Pliny* call the Firſt Species, and is by them likened to the Shaking Fit of an Ague, cauſing ſuch a Motion as Shakes the *Earth* from ſide to ſide. In this firſt almoſt all the Edifices in the Country were thrown down, whereof ſome were very high and ſtrong built Towers. A great part of the City of *Catania*, with many, others were Demoliſh'd, and a great many buildings in *Val di Noto*, *Syracuſa* was alſo much ſhattered, but not Ruined. This was not Preceded by any Darkneſs in the Air, but a Pleaſing, Serene, Warm Time, which was the more Obſervable, as being Unuſual at that Time of the Year, yet it was not to any Exceſs.

Some Perſons, which the Evening before were Travelling in the Country, obſerved a great Flame or Light, at about an *Italian* Miles Diſtance, and ſo Bright, that they took it for a real Fire made by ſome of the Country People; and though they went directly towards it, yet it ſeemed to keep at the ſame diſtance from them. Whilſt they were obſerving this Appearance, the *Earthquake*, began which was ſenſible even to the Horſes they rode upon, that were Affrighted thereat, and the Trees were all ſhaken. Upon this, the Amazed Travellers looked for the Light they ſaw juſt before, found it quite Vaniſht. We perceiv'd, turning towards the Sea, that the Waves which before the Shake only beat gently upon the Shoar, began now to make a dreadful Noiſe. The next Day, which was the 10*th*, the Night and Day following, the Air was Overſhadowed with Darkneſs, and Tinged with a deep Yellow, and the Obſcured *Sun* ſtruck our Minds with a Melancholy Preſage of the Approaching *Earthquake*; Which was the 2*d*, and happen'd on the 11*th* of the ſame *January*, about the 21 Hour, and laſted about 4 Minutes. It was much like the 2*d Sort*, which *Ariſtotle* and *Pliny* call a *Pulſe* or *Stroke*, for its reſemblance to the beating of an Artery. And by *Poſſidonius* in *Seneca*, is Repreſented by the Name of *Vibrations*, it being a Perpendicular Lifting up of the *Earth*. Its *Impulſe* was ſo Vehement and Powerful, that not only many Cities and Countries of the Kingdom of *Naples*, but the Iſland of *Malta* participated alſo of its Fury. It was in this Country impoſſible to keep upon our Legs, or in one Place on the Dancing *Earth*; nay, thoſe that lay along on the Ground, were toſſed from ſide to ſide, as if on a Rolling Billow.

In open places the *Sea* ſunk down conſiderably, and in the ſame proportion in the Ports and incloſed Bays, and the Water bubled up all along the Shore.

The *Earth* opened in ſeveral Places in very long Clefts, ſome an Hand's breadth, others half a Palm, others like great Gulfs. From theſe openings that were in the Valleys, ſuch a quantity of Water Sprung forth as overflowed a great ſpace of Ground, which to thoſe that were near it, had a ſenſible *Sulphureous Smell*, though in a low degree, and without that unpleaſant Stifling produced by the Smoak of *Brimſtone*.

In the Plain of *Catania*, an open Place, it is reported, that from one of theſe Clefts narrow, but very long, and about 4 Miles off the *Sea*, the Water was thrown forth altogether as *Salt* as that of the *Sea*.

In the City of *Noto* is a Street of half a Mile long, Built of Stone, which at preſent is ſettled into the Ground, and quite hanging on one ſide, like a Wall that Inclines; and in another Street before the *Aſſent del Durbo*, is an opening big enough to ſwallow a Man and Horſe.

Great Rocks were looſened and thrown down from the Mountains every where: And in the Country of *Sotino*, Inhabited by about 5000 Perſons, a great Number Periſhed in the Houſes which were beaten down by them in their way, as they rolled down from the Hills. A great Ciſtern or Reſervatory of Water Hollowed on the top of a Rock was looſen'd and thrown off from the reſt of the Rocks, and ſlid down to the Bed of the River that runs in the bottom, where the Ciſtern remains as it was full of the ſame Water it had received before the *Earthquake*.

A very great many *Grotto's* made by Art or Nature, are now fallen in.

In *Syracuſa* and other places near the *Sea*, the Water in many *Wells*, which at firſt were *Salt*, are become *Freſh*, and have not as yet loſt their Goodneſs, ſo they are ſtill fit to Drink.

The Fountain *Arethuſa*, for the ſpace of ſome Months, was ſo Brackiſh, that the *Syracuſans* could make no uſe of it; and now that it is grown Sweeter, its Spring is encreaſed to near double.

In the City of *Termini* all the running Waters are dryed up and amongſt the reſt a ſmall River near to it, with which they Watered their Gardens and Orchards. It was contrary to the *Hot Baths*, which were Augmented by a 3*d* part of what they were before the *Earthquake*.

In many plain and level places very high Walls leaped from their Foundations above two paces, leaving that whole ſpace perfectly clear and free from Rubbiſh and Ruins, as if they had been taken up and carried off. And in *Syracuſe*, two Side-Walls of a ſmall Houſe Jumped up from each other, the one upright, and ſtood upon its bottom at a great Diſtance from its former place; and the other, leaving its Companion, flew away ſo as to make an Angle with the other, to the wonder of the Beholders of ſo Extravagant an Accident. Not for from the Country of *Caſſaro*, from the Tops of 2 Mountains, between which through a long Valley ran a River, two very great Rocks were looſened, which trumbling down over againſt each other, met ſo exactly as to cloſe up the Valley, and ſtop the Current of the River, which not finding any *Subterraneous* or ſide Paſſage, has fill'd up the Valley to the top of the Rocks that were thrown down, and runs over them, forming a Lake 3 Miles round of a conſiderable depth.

In the Territory of *Sortini*, in a piece of ground half a Mile long, but much narrower, the Ground at ſeveral little interſtices, is ſunk from the Level in ſome places Two, in other Three *Palms*, and ends in a very deep Circular Gulf or Swallow.

A Fountain in the very Minute of the *Earthquake* on the 11*th* threw forth its Waters Tinged of a Blood-red, which continued for 3 Hours, aud then it dryed up, leaving many Holes in the Mud at the bottom, through which real Aſhes were thrown out; and the next Day the Waters returned of the former Quality, without the leaſt Alteration.

In the City, encompaſſed with Caves on 3 ſides, although by the conſiderable Shakes that were given it there was not much Ruine made, yet a very dreadful Sound and Noiſe was heard for a great while.

The South Winds have blown very much, which ſtill have been impetuous in the moſt Senſible *Earthquakes*, and the like has happened at other times.

From the 11*th* of *Jan.* to this 14*th* of *Sept.* there have been conſiderable and ſtrong South Winds, preceded by a Noiſe like Cannon at a great diſtance, ſome of a longer, ſome of a ſhorter continuance; this has been obſerved in all parts, but lowder in Cavernous places, and in the Valleys between the Mountains, where the Shakes were more Violent, in proportion to the Diſtance from the *Sea*.

Darkneſs and Obſcurity of the Air has always been over us, but ſtill Inferiour to that on the 10*th* and 11*th* of *Jan.* and often theſe Clouds have been thin and light, and of a great Extent, ſuch as Authors call *Raræ Nubeculæ*. The Sun often, and the Moon always Obſcured at the Riſing and Setting; and the Horizon all day long Dusky, ſo that our wonted Proſpects are ſhortned; but for ſome little time paſt it has grown ſomething clearer.

The heat at the beginning of Summer was not Extream, but the Sun entering *Virgo*, it grew very great, and at Noons Intolerable.

Since the Firſt of *Auguſt*, which was a moſt Tempeſtuous Day, not only for the Exceſſive Rains for about 4 Hours, but for the Hail and very Loud Thunder, the Shakes of the *Earthquake* have been leſs ſenſible and ſeldomer, and for two Months not ſo Univerſal, but ſometimes in one place, ſometimes in another.

It has been obſerved that in leſs ſolid Ground ſuch as Chalk, Sand or looſe Earth, the Miſchief was without Compariſon greater than in the Rocky places. And in *Syracuſa* the Difference was Viſible in 3 places; that is in the middle of the City, in the little Iſland, and in *Zaracati* where the Ancient *Syracuſa* ſtood; in all which places the Buildings being on a Rocky Foundation remain for the moſt part untouch'd, or only Shaken, or at leaſt not quite Demoliſhed. Whereas on the contrary, in the reſt of that Territory which is not Rocky, a very great Number of Noble Structures and Towers lie like a Horrid Deſart, and Heap of vaſt Ruines.

The Effects it has had on human Bodies, altho' I do not believe they have all immediately been cauſed by the *Earthquake*, have yet been various, ſuch as *Fooliſhneſs*, but not to any great Degree; *Madneſs*, *Dulneſs*, *Sottiſhneſs* and *Stolidity* every where: *Hypochondriack*, *Melancholick*, and *cholerick* Diſtempers. Every Day *Fevers* have been common, with many continual and *Tertian*; *Malignant*, *Mortal* and *Dangerous* ones in a great number, with *Deliria* and *Lethargies*. Where there has been any Infection caus'd by the *natural malignity* of the *Air*, infinite *mortality* has follow'd. The *Small Pox* has made great Deſtruction among young Children; and in ſhort, there has been no State, nor Condition, which has not had its Share in ſo univerſal a Calamity.

The Number of Inhabitants before the Earthquakes, and of thoſe that Periſhed therein.

The Names of the Cities.	*Number of* Inhabit	*Num. of thoſe kill'd.*	*Names of the* Cities.	*Numb. of* Inhab.	*Numb. o tho kill'd.*
Agoſta.	6173	2300	*Mazzarino*	7695	
S. Agatha.	1402	20	*Nicoloſi.*	844	4
Avola	6225	800	*Nixerni.*	1483	
Buſcema.	2192	900	*Noto.*	12043	3000
Bonaccurſo.	844	94	*Occhiella.*	2910	10
Bontello.	172	2	*S. Giovanni Lapunta.*	1032	15
Butera.	3492		*Jaci Reale.*	12895	73
Buccheri.	3295	30	*Jaci S. Antonio.*	6363	1335
Caltagirone.	12339	800	*Leontini.*	10063	121
Catania.	18914	18000	*Licodia.*	4898	74
Comiſo.	5305	269	*Mineo.*		135
Caſtel di Jaci.	331	32	*Palagonia.*	1862	29
Carleontini.	2751	77	*Pedara.*	1582	475
Caſſaro.	1458	15	*Palazzolo.*	5571	70
Chiaramonte.	4830	303	*Raguſa.*	9946	5000
Floridia.	1037	20	*Sortino.*	6316	250
Ferla.	3610	800	*Syracuſa.*	15399	4000
Fenicia Moncada.	1651	14	*Scichili.*	9382	2000
Francofonte.	2039	345	*Scordia*	907	3
Giarlatana.	2981	541	*Spaccafurno.*	7987	2100
Maſcali.	1300	15	*Trezza.*		20
Maſſa Nunziata.	394	55	*Trecaſtagni.*	3264	1000
Militello Val di Noto	6438	600	*Terranova.*	5289	
S. Michele.	1838	1	*Tremiſteri.*	996	90
Melilli	5480	900	*Vittoria.*	3950	200
Monteneſſo.	234	232	*Terra Grande o Viu (Grande*	1602	20
Modica.	18203	3400	*Vizzini.*	10678	2000
			Sum	254[illegible]36	59963

An Earthquake at Lima 1687. By P. Alvarez de Toledo. n. 209 p. 81.

XVIII. On *Monday*, *Oct* 20. 1687. (*N. S.*) at 4 of the Clock in the Morning, came a Horrible *Earthquake* and *Noiſe*, with which ſome Houſes fell, and ſome Perſons were kill'd under their Ruines.

At 5 of the Clock in the ſame Morning was another Shake with the ſame Noiſe.

At 6 of the Clock in the aforeſaid Morning, when we thought we had been all in Safety, came another Shake with great Fury and Ruſhing Noiſe; The *Sea* with great Bellowing came beyond its Bounds; the *Bells* Rung of themſelves; and the Deſtruction was ſo great, that no Building ſtood. The *Noiſe* was ſuch, that thoſe in the Fields aſſure us, that the Cattle were in great Aſtoniſhment, *Callao*, *Canete*, *Piſco*, *Chancay*, and *Los Chorillos*, are all Ruined. There are more than 5000 Dead Bodies found, and they find more daily, ſo that we know not their Number.

An Earthquake in Jamaica. 1687. 8. By Dr. Hans Sloan. n. 209. p. 81.

XIX. The Inhabitants of *Jamaica* expect an *Earthquake* every Year, *&c.* Some of them are of Opinion, that they follow their great Ruins. One of them happened on *Sunday* the 19*th* of *Feb.* 168$\frac{7}{8}$. about 8 in the Morning. I found in a Chamber one Story high, the Cabinets, and ſeveral other Moveables on the Floor, to Reel as if the Foundations of the Houſe had been raiſed. I looked out at a Window to ſee what was the Matter, and found that the Pigeons, and other Birds in an Aviary hard by, were on their *Wings* in a great Aſtoniſhment. It came by Shocks; there were three of them, with a little Pauſe between. It laſted about a Minute of time in all; and there was a ſmall Noiſe accompanied it. A pair of Stairs higher it threw down moſt things off the Shelves, and had much more Viſible Effects than below. This was generally felt all over the Iſland, at the ſame Time or near it; ſome Houſes therein being Cracked and very near Ruin'd, others being uncovered of their Tiles, very few Eſcaped ſome Injury, and the People in them were generally in a great Conſternation, ſeeing them Dance. The Ships in the Harbour at *Port-Royal* felt it; and one who was Eaſtward of the Iſland coming thither then from *Europe*, met with, as he ſaid, at the ſame time, an *Hurricane*. One Riding on Horſe-back was not ſenſible of it. A Gentleman being at that time abroad in his Plantation, told me, he ſaw the Ground Riſe like the Sea in a Wave, as the *Earthquake* paſſed along, and that it went Northward; for that ſome ſmall time after he had felt it, he ſaw by the Motion of the Tops of the Trees on Hills ſome Miles diſtant, that it had then reached no further than that Place. The *Spaniards* who Inhabited this Iſland, and thoſe Neighbouring, built their Houſes very low; and they conſiſted only of Ground-Rooms, their Walls being made of Poſts, which were as much buried under Ground as ſtood above, on purpoſe to avoid the Danger which attended other manner of Building from *Earthquakes*. And I have ſeen in the Mountains a far off Bare Spots, which the Inhabitants told me, were the Effects of *Earthquakes* throwing down part of the Hills, which continued bare and ſteep.

XX. 1. The

An Earthquake in Jamaica, 1692. *By* . . . . . n. 209. p. 83.

XX. 1. The terrible *Earthquake* which happen'd *June* 7. 1692. between 11 and 12 of the Clock at Noon, Shook down and Drown'd 9 Tenths of the Town of *Port-Royal* in two *Minutes* time: And all by the *Wharf-ſide* in leſs than one; very few eſcaped there. I loſt all my People and Goods, my Wife and two Men, Mrs. *B.* and her Daughter. One White Maid eſcaped, who gave me an Account that her Miſtreſs was in her Cloſet two pair of Stairs high, and ſhe was ſent into the Garret, where was Mrs. *B.* and her Daughter, when ſhe felt the *Earthquake*, and bid her take up her Child and run down; but turning about, met the Water at the top of the *Garret Stairs*; for the Houſe Sunk downright, and is now near 30 Foot under Water. My Son and I went that Morning to *Liguania*, the *Earthquake* took us in the Mid-way between that and *Port-Royal*, where we were near being overwhelmed by a Swift Rowling Sea, 6 Foot above the Surface, without any Wind; but it pleaſed God to ſave us, being forced back to *Liguania* where I found all Houſes even with the Ground; not a place to put ones Head in, but in *Negro* Houſes. The *Earth* continues (*June* 20) to ſhake 5 or 6 times in 24 Hours, and often Trembling. Great part of the Mountains fell down, and fall daily. I pray God divert thoſe heavy Judgments which ſtill threaten us.

By . . . . Ib.

2. We have had a very great *Mortality* ſince the *Great Earthquake* (for we have little ones daily) almoſt half the People that eſcaped upon *Port-Royal* are ſince Dead of a *Malignant Fever*, from Change of Air, want of dry Houſes, Warm Lodging, Proper Medicines, and other Conveniences. *September* 23. 1692.

By . . . . Ib. p. 88.

3. A great Part of *Port-Royal* is ſunk; that where the Wharfs was, is now ſome Fathoms of Water: All the Street where the Church ſtood, is *overflowed*, that the Water ſtands ſo high as the upper Rooms of thoſe Houſes which are ſtanding. The *Earth* when it opened, ſwallowed up People, and they roſe in other Streets; ſome in the middle of the Harbour, and yet were ſaved; though at the ſame time I believe there was loſt about 2000 Whites and Blacks. At the North above 1000 Acres of Land ſunk, and 13 People with it. All our Houſes were thrown down all over the Iſland, that we were forced to live in Hutts. The 2 great Mountains at the entring into 16 *Mile-Walk* fell, and met, and ſtopt the River, that it was dry from that Place to the *Ferry* for a whole Day; and vaſt quantities of Fiſh taken up, which was greatly to the Relief of the Diſtreſſed. At *Yellows* a great Mountain Split, and Fell into the Level Land, and Covered ſeveral Settlements, and deſtroy'd 19 White People. One of the Perſons whoſe Name was *Hopkins*, had his Plantation *Removed* half a Mile from the Place where it formerly ſtood; and now good Proviſions grow upon it. Of all Wells from one Fathom to 6 or 7, the Water flew out at the Top with the great Motion of the *Earth*. Since, it has continued ſhaking ſometimes two or three times in a Day, ſo at Night, ſometimes more, ſometimes leſs; but God be praiſed they are but ſmall. Our People ſettled a Town at *Leguanca-ſide*, and there is about 500 Graves already, and People are every Day a dying Still. *Sept.* 20. 1692.

4. Be-

By..., ib. p. 85. 4. Between Eleven and Twelve a Clock, we felt the Tavern (where I then was) Shake, and ſaw the Bricks begin to riſe in the Floor, and at the ſame Inſtant heard one in the Street cry, *An Earthquake.* Immediately we ran out of the Houſe, where we ſaw all People with lifted up Hands, begging God's Aſſiſtance. We continued running up the Street, whilſt on either ſide us, we ſaw the Houſes, ſome ſwallowed up, others thrown on Heaps; the Sand in the Street riſe like the Waves of the Sea, lifting up all Perſons that ſtood upon it, and immediately dropping down into Pits, and at the ſame Inſtant a Flood of Water breaking in, and rowling thoſe poor Souls over and over; ſome catching hold of Beams and Rafters of Houſes, others were found in the Sand that appeared, when the Water was drained away, with their Legs and Arms out; we beholding this Diſmal Sight; the ſmall piece of Ground whereon 16 or 18 of us ſtood (praiſed be God) did not ſink. As ſoon as the Violent Shake was over, every Man was deſirous to know if any part of his Family were left alive. I endeavoured to go towards my Houſe upon the Ruines of the Houſes, that were floating upon the Water, but could not: At length I got a *Canoa*, and row'd up the great Sea-ſide towards my Houſe, where I ſaw ſeveral Men and Women floating upon the Wreck out to Sea; and as many of them as I could, I took into the Boat, and ſtill rowed on till I came where I thought my Houſe had ſtood, but could hear of neither my Wife nor Family. Next Morning I went from one Ship to another, till at length it pleaſed God that I met with my Wife and two of my Negroes. She told me when ſhe felt the Houſe Shake, ſhe ran out and called all the Houſe to do the ſame: She was no ſooner out, but the Sand lifted up; and her *Negro* Woman graſping about her, they both dropt into the *Earth* together; and at the ſame inſtant, the Water coming in, Rowled them over and over, till at length they catched hold of a Beam, where they hung till a Boat came from a *Spaniſh* Veſſel and took them up.

The Houſes from the *Jews-Street* End to the *Breaſt-work* were all ſhak'd down, ſave only 8 or 10 that remained from the Balcony upwards above Water: And as ſoon as the violent *Earthquake* was over, the Watermen and Sailers did not ſtick to Plunder thoſe Houſes; and in the time of their Plunder one or two of them fell upon their Heads by a ſecond *Earthquake*, where they were loſt.

As ſoon as the violent Shake was over, the Miniſter deſir'd all People to join with him in Prayer; and amongſt them were ſeveral *Jews* that kneeled, and anſwered as they did. Nay, I heard one ſay, They were heard to call upon *Jeſus Chriſt*: A thing worth Obſervation.

Several Ships and Sloops were Overſet and Loſt in the Harbour: Amongſt the reſt the *Swan Frigat* that lay by the Wharf to Careen, by the Violent Motion of the Sea, and ſinking of the Wharf, was forced over the Tops of many Houſes; and paſſing by that Houſe where my Lord *Puke* lived, part of it fell upon her, and Beat in her Round Houſe: She did not Overſet, but helpt ſome Hundreds in ſaving their Lives.

As to the *Fire-Balls* which you heard was ſeen in the Air, it was a great Falſhood; but a great and hideous Rumbling was heard in the Mountains, inſomuch that it frighted many Negroes that had been run away ſome Months from their Maſters, and made them come Home.

The *Water* that *Iſſued* from the *Salt-Pan-Hills*, forced its Paſſage, in I believe 20 or 30 ſeveral Places, ſome more forcibly than others: For in 8 or 10 Places, it came with that violence, that had ſo many Sluices been drawn up at once, they could not have run with greater Force and moſt of them 6 or 7 Yards High from the Foot of the Hill: 3 or 4 of the leaſt of them we obſerved were near 10 or 12 Yards high in the Mountain. We Taſted the *Water* in moſt of the Places and found it to be Brackiſh. It continued running that Afternoon, all Night and till next Morning about about Sun riſe, at which time the *Salt-Pans* were quite Overflowed.

The Mountains betwixt *Spaniſh-Town* and 16 *Mile-Walk*, as the way lies along the River, if you remember about the Midway they are almoſt Perpendicular, eſpecially on the other ſide the River; thoſe two *Mountains* in the *Violent Shake* of the *Earthquake* joined together, which ſtopt the Paſſage of the River, and forced it to ſeek another, which was a great way in and out amongſt the Woods and *Savana*'s; for (as I have heard by ſeveral hands) it was 8 or 9 days before the Town had any Relief from it: Inſomuch that before it came, the People were in Thoughts of Removing into the Country, concluding it had been ſunk as *Port-Royal* was. The *Mountains* along the River are ſo *Thrown on Heaps*, that all People are forced to go by *Guanaboa* to the 16 *Mile-Walk*.

Mr. *Bosby* (who with his Wife had a Miraculous Eſcape) told us, That that Afternoon, coming to his Plantations, he found the Ground opened in ſeveral places; and in one two *Cows* were dropt in and ſmothered.

The *Weather* was much *Hotter* after the *Earthquake* than before; and ſuch an Innumerable Quantity of *Muſquetoes*, that the like was never ſeen ſince the Inhabiting of the Iſland.

The *Mountains* at *Yellowes* far'd no better than thoſe of 16 *Mile-Walk*, a great part of one of them falling down, drove all the *Trees* before it, and at the Foot of the *Mountain*, there was a Plantation that was wholly Overthrown and Buried in it.

The *Mountains* in *Loguanee* fell in ſeveral places, and in ſome very ſteep. Ib. p. 88.

The *Water* in the Streets of *Port-Royal* did not ſpout up as you have heard, but in the *Violent Shake* the *Sand* cracking and opening in ſeveral places where People ſtood, they ſinking into it, the *Water* boiled out of the *Sand*, that covered many and ſaved others.

5. The Year 1692. began in *Jamaica* with very dry and hot Weather, which continued till *May*, when there was very *Blowing Weather* and much Rain till the End of the Month, from which time till the *Earthquake* happened, 'twas exceſſive Hot, Calm, and Dry; and on *Tueſday* the 7*th* of *June*, about 40 Minutes paſt 11 in the Forenoon, it being then a very Hot, Clear, Sun-ſhine Day, ſcarce a Cloud to be ſeen in the *Sky*, or a Breath of Air to be felt, happen'd that *Great Shake*, ſo fatal to this Place, and to the whole Iſland. By —— *Communicated by Dr.* Love Morley. Ib. 89.

It began with a ſmall Trembling, ſo as to make People think there was an *Earthquake*, which Thoughts were immediately confirmed by a ſecond *Shake* ſomething ſtronger, accompanied all the while with a *Hollow Rumbling Noiſe*, almoſt like that of Thunder, which made them begin to Run out of their Houſes. But alas! this was but ſhort Warning for them to provide for their Safety; for at the Heels of this ſecond, came the *Third Violent Shake*, which in leſs than a Minutes Time (it continuing near a Minute) ſhook the very *Foundation* of *Port-Royal* in ſuch a ſort that I believe 3 parts in 4 of the Houſes, and the Ground whereon they Stood, and moſt part of thoſe who inhabited them, all Sunk at once quite under Water; and on the place which was left, and is now ſtanding, Shook down and ſhatter'd the Houſes in ſo violent a manner, that at our Landing it looked more like a Heap of Rubbiſh, than any thing elſe, there being, I believe, ſcarce one Houſe in ten left ſtanding, and thoſe ſo Crack'd and Shatter'd that few of them were fit, or thought ſafe to live in, and ſtand now (*July* 3. 1693) Empty. All thoſe Streets which were next the *Water*, towards the *Harbour-ſide*, where there were Excellent *Wharfs*, cloſe to which *Ships* of 700 Tun might lie and deliver their Loading, where were the beſt Store Houſes and conveniencies for Merchants; where were brave Stately Buildings, where the Chief Men of the place lived, and which were in all reſpects the Principal parts of *Port-Royal*, now lie in 4, 6, or 8 *Fathom Water*. That part which is now ſtanding, is part of the End of that Neck of Land which runs into the Sea, and makes this *Harbour* (at the Extremity of which ſtands the *Fort*, not *Shook* down but much *Shatter'd* by the *Earthquake*) and is now a perfect Iſland; the whole Neck of Land from the *Fort* of *Port-Royal* now ſtanding to the *Palliſadoes*, or other end *Port-Royal* towards the Land, (which is above a Quarter of a Mile) being quite diſcontinued and loſt in the *Earthquake*; and is now alſo with all the Houſes, which ſtood very thick thereon, quite under *Water*; all which part or Neck of Land (which is diſcontinued) as alſo all the other parts of this Place which *Sunk*, were, for what I can Learn, nothing but Perfect *Sands* and by the People driving down Timber and Wharfing, *&c.* were by little and little gained in time out of the *Sea*, which now has at once recovered all again.

Capt. *Hals* and ſome others ſay, That when they came hither with *Venables*, the Place whereon *Port-Royal* was ſince Built, was like one of the Keys or little Iſlands that lie off this *Harbour*, (which by the way are all ſtanding) but continued by a ſmall Ridge of *Sand*, which then juſt appear'd above *Water*, with the other part of the Neck of Land, and I believe there is now as much Ground left ſtanding as then.

And one, who had been there ſome Years before under one *Jackſon* (who took and plundred St. *Jago*, *&c.* and return'd with *Venables*, told Capt. *Hals* at his coming hither, that the *Point* or Place now ſtanding, when he was here before under the ſaid *Jackſon*, was wholly Separated from the Land by the *Sea*, (as it is at this time) and Pointing to the Ridge of *Sand* above-mentioned, ſaid, That did not appear when I was here before. This is very Probable, for already ſince the *Earthquake*, the *Sandy-Ground* at the *Palliſadoes*, or other ſide, hath gained from the *Sea* ſeveral Acres. On this *Sandy* Neck of Land did People Build great Heavy Brick Houſes whoſe Weight, on ſo *Sandy* a Foundation, may be ſuppoſed to Contribute much to their downfal; for the Ground gave way as far as the Houſes ſtood only, and no further; part of the *Fort* and the *Palliſadoes*, at the other end of the Houſes, ſtanding.

This Part of *Port-Royal* which is now ſtanding, is ſaid to ſtand upon a Rock: But alas! The ſtrange *Rents* and *Tearings* of the *Mountains* here, ſufficiently evince, that *Rocks* and *Sands* are equally able to withſtand the Force of a *Violent Earthquake.* If this place be nothing but *Sand* (as ſome would have it, that are it's no Well-Wiſhers) it ſeems ſtrange that the Force of the *Earthquake* did not Diſſipate and Diſſolve the very Foundation of it, and that it did not fall to pieces and ſcatter under *Water*, as the reſt of the Place did; for the *Shake* was ſo Violent, that it *Threw* People down on their Knees, and ſometimes on their Faces, as they run along the Streets to Provide for their Safety, and it was a very difficult matter to keep one Legs. The Ground heav'd and ſwell'd like a rolling ſwelling *Sea*; ('tis a ſtrange Compariſon but every Body here uſing it, I venture to do ſo likewiſe) by which means ſeveral Houſes now ſtanding were Shuffled and Moved ſome yards from their Places. One whole Street (a great many Houſes whereof are now alſo ſtanding) is ſaid to be twice as broad now, as before the *Earthquake*, and in many Places the Ground would Crack, and open and ſhut, quick and faſt: Of which ſmall Openings I have heard Major *Kelley* and others ſay, they have ſeen 2 or 3 Hundred at one time, in ſome whereof many People were Swallowed up; ſome the *Earth* Caught by the Middle, and ſqueezed to Death, the Heads of others only appeared above Ground, ſome were ſwallowed quite down, and caſt up again with great quantities of Water, others went down and never were more ſeen. Theſe were the ſmalleſt Openings: Others that were more large, ſwallowed up great Houſes, and out of ſome Gapings would Iſſue forth whole Rivers of *Water* ſpouted up a great height into the Air, which ſeemed to threaten a Deluge to that part of *Port-Royal*, which the *Earth* ſeemed to favour, accompanied with Ill Stenches and Offenſive Smells: By means of which Openings, and the Vapours at that time belch'd forth from the *Earth* into the *Air*, the Sky which before was Clear and Blue, was in a Minutes time become Dull and Reddiſh, (as I have heard it compared often) like a Red-Hot Oven. All theſe Dreadful Circumſtances occurring at once, accompanied all the while with Prodigious Loud *Noiſes* from the *Mountains*, occaſioned by their Falling, &c. and alſo a hollow *Noiſe* under Ground, and People running from one place to another, with Fear looking like ſo many Ghoſts, and more reſembling the Dead than the Living, made the whole ſo Terrible, that People thought the Diſſolution of the whole Frame of the World was at hand. Indeed 'tis enough to raiſe Melancholy Thoughts in a Man now, to ſee the *Chimneys* and *Tops* of ſome *Houſes*, and the *Maſts* of *Ships* and *Sloops*, which partook of the ſame Fate, appear above Water; and when one firſt comes a ſhore, to ſee ſo many Heaps of Ruines, many whereof by their largeneſs ſhew, that once there had ſtood a brave Houſe; to ſee ſo many Houſes ſhattered, ſome half fallen down, the reſt deſolate and without Inhabitants; to ſee where Houſes have been ſwallowed up, ſome appearing half above ground, and of others the Chimneys only; but above all to ſtand on the Sea-ſhore, and to look over that part of the Neck of Land, which for above a quarter of a Mile was Swallowed up, there, where once brave Streets of ſtately Houſes ſtood, appearing now nothing but Water, except here and there a Chimney, and ſome Parts and Pieces of Houſes, ſerving only to mind us of their ſad Misfortune.

And tho' *Port-Royal* was ſo great a ſufferer by the *Earthquake*, yet it left more Houſes ſtanding there, than in all the Iſland beſides. It was ſo violent in other places, that People could not keep their Legs, but were violently thrown down on the ground, where they lay on their Faces with their Arms and Legs ſpread out, to prevent being Tumbled and thrown about by the Incredible Motion of the *Earth*, like that as is the general Comparison of a great Sea. It ſcarce left a Planter's Houſe or Sugar Work ſtanding all over the Iſland: I think it left not a Houſe ſtanding at *Paſſage-Fort*, and but one in all *Liguanee*, and none in *St. Jago*, except a few low Houſes built by the Wary *Spaniards*. And 'tis not to be doubted, but that had there been 500, or 5000 Towns in *Jamaica*, the *Earthquake* would have ruined every one. In ſeveral Places in the Country the *Earth* Gaped prodigiouſly: On the North ſide the Planters Houſes with the greateſt part of their Plantations, (and the Planters Houſes be not very near to one another) were *Swallowed*, Houſes People, Trees, all up in one Gape; inſtead of which appeared for ſome time after a great Pool or Lake of Water, covering above 1000 Acres, which is ſince dryed up, and now is nothing but a Looſe *Sand* or *Gravel*, without any the leaſt Mark or Sign left whereby one may Judge, that there ever had ſtood a Tree, Houſe or any thing elſe. In *Clarendon* Precinct, the *Earth* Gaped, and Spouted up with a prodigious force great quantities of *Water* into the Air, above 12 Miles from the *Sea*; and all over the Iſland, there were abundance of Gapings, or Openings of the *Earth*, many thouſands; Marks of many whereof, which upon their Cloſing they left behind them, any one cannot chuſe but ſee, that goes into the Country; and I have ſeen ſeveral. But in the *Mountains* are ſaid to be the moſt violent Shakes of all; and 'tis a generally received opinion, that the nearer to the *Mountains*, the greater the *Shake*; and that the Cauſe thereof, whatever it is, lies there. Indeed they are ſtrangely Torn and Rent, inſomuch that they ſeem to be of quite different Shapes now from what they were, eſpecially the *Blew*, and other *Higheſt Mountains*, who ſeem to be the greateſt ſufferers; which during the time of the firſt great *Shake*, and as long as the great *Shakes* continued, which was above Two Months after the firſt *Shake*, (during which time the *Shakes* came very ſtrong and thick, ſome times 2 or 3 in an hour) bellowed out Prodigious Loud *Noiſes* and *Echoings*.

Not far from *Yellowes*, Part of a *Mountain*, after having made ſeveral *Leaps* or *Moves*, Overwhelmed a whole Family, and a great part of a Plantation, lying a Mile off. And a large *High Mountain*, near *Portmorant*, near a Days Journey over, is ſaid to be quite *Swallowed* up; and in the place where it ſtood there is now a great *Lake* of 4 or 5 *Leagues* over.

In the *Blew Mountains* and its nigh Neighbours, from whence came thoſe Dreadful Roarings, Terrible and Amazing to all that heard them, may be reaſonably ſuppoſed to be many ſtrange Alterations of the like Nature: but thoſe Wild, Deſert Places, being very rarely or never viſited by any body, not by Negro's themſelves, we are yet Ignorant of what happened there. But whereas they uſed to afford a fine Green Proſpect, now one half part of them at leaſt, ſeem to be wholly deprived of their Natural *Verdure*. There one may ſee, where the Tops of great Montains have fallen, ſweeping down all the Trees, and every thing in its Way, and making a Path quite from Top to Bottom; and other Places, which ſeem to be Peeled, and Bare a Mile together; which vaſt Pieces of *Mountains*, with all the Trees thereon, falling together in a Huddled, and Confuſed manner, Stopped up moſt of the Rivers for about 24 Hours, which afterwards having found out new Paſſages brought down into the Sea, and this Harbour, ſeveral Hundred Thouſand Tun of Timber) as I have heard computed from the moſt knowing People there, which would ſometimes float in the Sea in ſuch prodigious Quantities, that they looked like moving Iſlands. I have ſeen ſeveral of thoſe large Trees on this Shore, all deprived of their Bark and Branches, and generally very much Torn by the Rocky Paſſages, through which, by the force of a falling Stream and their own Weight, they might be ſuppoſed to be driven. One great Trunk of a Tree particularly, I have ſeen amongſt the reſt, ſo ſqueezed as a Sugar Cane after it had paſſed the Mill. Some are of Opinion that the *Mountains* are *Sunk* a little, and are not ſo high as they were; others think the whole Iſland is *Sunk* ſomething by the *Earthquake*. *Port-Royal* is ſaid to be *Sunk* a Foot; and in many Places in *Liguanee*, I have been told, are Wells which require not ſo long a Rope to draw Water out of them now as before the *Earthquake* by 2 or 3 Foot.

In this Harbour in *Port Royal* at the time of the *Great Shake* (though the Seas were very Calm) was ſuddenly raiſed ſuch a ſtrange *Emotion* in the Water, that immediately it ſwelled as in a Storm, great large Waves appearing on a ſudden Rolling with ſuch a force, that they drave moſt Ships (if not all) in the Harbour from their Anchors, breaking their Cables in an Inſtant; but this was ſoon over, and in a little time all was ſmooth again. One Capt *Phips* told me, That he and another Gentleman happened at the time of the *Earthquake*, to be in *Leguanee* by the Sea-ſide; and that at the time of the *Great Shake*, the Sea Retired from the Land in ſuch ſort, that for 2 or 3 Hundred Yards the Bottom of the Sea appeared dry, whereon they ſaw lye ſeveral Fiſh, ſome whereof the Gentleman who was with him ran and took up, and in a Minute or two's time the Sea returned again and overflow'd great part of the Shore. At *Yallhouſe* the Sea is ſaid to retire above a Mile.

'Tis thought there were loſt in all Parts of the Iſland 2000 People, and had the *Shake* happened in the Night, very few would have eſcaped alive.

Since my Arrival here I have felt ſeveral *Shakes*, the firſt and greateſt whereof was on *Good Friday*, 1693. it lifted me compleatly off my Chair, and ſet me on my Legs, and was ſaid to be a ſmall *Shake*: but I did not then hear the Noiſe (minding ſomething elſe) which always immediately foreruns or rather Accompanies it, but I have ſince felt ſeveral leſs *Shakes*, and heard the *Noiſe* often, which is very loud, and may be eaſily taken, by thoſe not uſed to hear it, for a Ruffling Wind, or for a Hollow Rumbling Thunder; but hath ſome Puffing Blaſts peculiar to it ſelf, and are moſt like thoſe of a Match made of *Brimſtone*, when lighted, but in a much greater Degree, and ſuch as a large Magazine of *Brimſtone* may be ſuppoſed to make, when on Fire. It is obſervable, that every ſmall *Shake* is felt on Ship-board as ſenſibly as on Shore, the *Water* ſhaking as well as the Land.

It is likewiſe obſerved, that in Windy Weather there never comes a *Shake*, but in very calm Weather it is always expected. This Obſervation hath held true in every *Shake* that hath happened ſince the firſt great One.

'Tis obſerved, that after Rain, they are generally ſmarter than at other times; which may be from the ſhutting up of the Pores of the *Earth*, whereby the Force is more Pent in, and hath not ſo free a Paſſage as to Perſpire and ſpend it ſelf, *&c.*

Shakes often happen in the Country, not felt at *Port-Royal*; and ſometimes are felt by thoſe that live in and at the foot of the *Mountains*, and by no Body elſe.

'Tis obſerved, That ſince the *Earthquake*, the *Land-Breezes* often fail us, and inſtead thereof, the *Sea-Breezes* often blow all Night; a thing rarely known before but ſince common.

In *Port-Royal*, and in many places all over the Iſland, much *Sulphureous*, Combuſtible Matter hath been found, ſuppoſed to have been thrown out, upon the opening of the *Earth*, which upon the firſt touch of Fire, would Flame and Burn like a Candle.

St. *Chriſtophers*, one of the *Caribee-Iſlands*, was heretofore much troubled with *Earthquakes*, which upon the *Eruption* of a great Mountain there of Combuſtible Matter, which ſtill continues, wholly ceaſed, and have never been felt there ſince: Wherefore many expect ſome ſuch Eruption in ſome of the Mountains here, though we hope there is no neceſſity for it; the *Shakes* having been obſerved to loſe their Force, and to become Weaker and Weaker ever ſince the firſt Fatal one; and 'tis now ſo long ſince we have heard any, except now and then one ſo Weak as ſcarce to be felt, that we have great Hopes they will now quite ceaſe.

After the great *Shake*, thoſe People that eſcaped, (as many as could) got on board the Ships in the Harbour, where many continued above 2 Months after; the *Shakes* all that time being ſo Violent, and coming ſo Thick, ſometimes two or three in an Hour's Time, accompanied with frightful Noiſes, both from under the *Earth*, and from the continual Falling and Breaking of the *Mountains*, that they dared not come Aſhore. Others went to the place call'd *Kingſtown* (or by others *Killcown*) where, from the firſt Clearing of the Ground, and from bad Accommodations, the Huts built with Boughs, and not ſufficient to keep out Rain, which in a great and an unuſual manner followed the *Earthquake*, lying Wet, and wanting Medicines, and all Conveniences, *&c.* they dyed miſerably in Heaps. Indeed there was a general

neral *Sickneſs*, (ſuppoſed to proceed from the hurtful Vapours belched from the many Openings of the *Earth)* all over the Iſland, ſo general that few ſcaped being Sick; and 'tis thought it ſwept away in many parts of the Iſland, 3000 Souls; the greateſt part from *Kingſtown* only, yet an Unhealthy Place. Beſides the great quantities of dead People Floating from one ſide of the Harbour to the other, as the *Sea* and *Land-Breezes* blew them, ſometimes 100 or 200 in a Heap, may be thought to add ſomething to the *Unhealthfulneſs* of this Place. *July* 3. 1693.

6. Moſt of the *Ships* loſt their Anchors and Cables which were towards the Wharfs or Town, which I ſuppoſe came from the Sands and Houſes falling on them; and they, after the *Earthquake*, rode in fewer Fathoms Water than before; and one may believe that ſome of the *Phænomena* may be Accounted for from that.

By Dr. Sloan. ib. p. 80.

XXI. The *Earthquake* which happen'd between the 4*th* and 5*th* of *Jan.* 1699. hath had ſtrange Effects about the *Tungarouſe* and *Batavian Rivers*. The great *Batavian* River from above *Tangala Warna* being a Place from whence the ſaid River receiveth the greateſt part of its Water, is ſtopt up, or covered with *Earth* from the *Faln Hills*, till beyond the River *Tſyouſpokitſyl*; ſo that the Place where the River had its Courſe formerly, was not to be ſeen. But far beyond that Hill towards *Batavia*, the Water comes forth again from under the *Earth*, which is ſunk down, but Thick and Muddy, paſſing over and thorow the Trees, wherewith the River was formerly ſtopt up. The Trees lying in the River are of a ſpecial Bigneſs, and ſo cloſe Packt together, that it is impoſſible to conceive how they came ſo.

An Earthquake *in* 1699. *at* Batavia; *ſent to* M. Nich. Witzen. *By* . . . . . n. 264. p. 595.

From the Mountains ſituated near the beginning of the *Batavian River*, called by the *Javanians Songſy-tſialiwong*, ſeven Hills are ſunk down, *viz.* 5 on this ſide, and 2 on the other. But the *Mount* from whence the River hath alſo its ſource, above *Tangel Warna*, within the Mountains *Terbackti*, is not ſunk down, nor hath received any Damage.

The *Tangarang* River, call'd by the Natives *Songhy Sedany*, is alſo ſtopt up, and covered with *Earth*, from the Hill and Branch *Salack*, to the River *Antum*, and from thence to *Tangarang*, being fill'd up with Trees; but not in ſuch a Quantity, nor ſo cloſe together, as in the *Batavian* River. On this ſide the *Tangarang* River, 9 are ſunk down by the *Earthquake*; and Seven Branches, that had formerly their Iſſue in the River *Tangarang*, are alſo covered with the *Earth*; but Three other Hills, lying alſo on this ſide of the ſame River, and call'd *Minjan*, *Dauw*, and *Halſichi*, had not ſuſtained any Damage, whereby the Branches *Autan* and *Kaniki*, (the latter into the firſt Branch, and the firſt into the River *Tangarang*) have kept their Courſe. And the Hill *Oudjong-teboc*, being call'd alſo *Sedani*, from whence the *Tangarang* River had its ſource, is not ſunk down nor hurted. It is alſo obſerved in the *Tangarang* River, at the Place where it is ſtopt up with Trees, that the deſcending Water being Thick and Muddy, went backward with a Motion not unlike the Waves of the Sea, when moved by a Tempeſt.

The High-Land between the *Batavian* and *Tangarang* Rivers, behind the old Court of the *Jaccatra* Kings, called *Pakowang*, having been a great Wood is changed ſince the *Earthquake*, into a great and open Field, wholly deſtitute of Trees, the Surface of the Ground being covered with a Red Clay ſuch as the Maſons uſe here; which in ſome places was ſo hard that it could endure Treading and going upon it, and in other places Men did Sink above a Foot into it. At the Place of the Old Court called *Pakowang* Situated between the *Batavian* and *Tangarang* Rivers, no other Damage hath been ſeen, than that the Land thereabouts hath been *Rent* and Divided aſunder with great Clefts more than a Foot wide. The River *Tſicome*, proceeding from a Pit or Well in the aforeſaid Court of *Pakowang*, and running a great way under Ground, and then coming forth again, taking its Courſe towards *Anke*, had not received any harm: But kept its Courſe uninterrupted.

The *Tommagon Porbo Nata* in his going towards the Mountains, heard a Noiſe like unto Thunder; and fearing that a ſinking down of the Ground, or an Eruption of Water would follow, he ſtood ſtill with thoſe that were about him, and ſaw afterwards that the *Earth* from the Top of the Mountains Sunk down; and hearing no further Noiſe, he went on his Journey, having in Going and Coming back ſpent 19 Days by the Way, and felt 40 times an *Earthquake*: And ſince his Return from the Mountains, he hath felt the like *Shakings* 208 times.

The Cauſe of Earthquakes and Vulcano's; By Dr Mart. Liſter. n.157.p 512 *De Font. Med.* Angl.

XXII. I have elſewhere ſhewn that the *Breath* of the *Pyrites* is *Sulphur ex tota Subſtantia*; Alſo that it naturally takes Fire of it ſelf; Again that the Material Cauſe of *Thunder* and *Lightning*, and of *Earthquakes* is one and the ſame; *viz.* the *Inflammable Breath* of the *Pyrites*; the Difference is, that one is Fired in the Air, the other under Ground: Of which laſt, theſe (I think) are ſufficient Arguments; A Thing burnt with *Lightning* Smells of very Brimſtone; again the Subtilty and Thinneſs of the Flame; alſo the Manner of its Burning, which is often obſerved to be *particulatim* or in ſmall Spots, Vapour like. And of *Earthquakes*, the Sulphureous Stink of Waters ſmelt before, and of the very Air it ſelf after them: Of which innumerable Inſtances occur in the Relations of them.

They alſo Agree in the manner of the Noiſe, which is to be carried on, as in a Train Fir'd, the one Rowling and Ratling through the Air, taking Fire as the Vapours chance to drive, as the other fir'd under Ground in like manner Moves with Deſultory Noiſe, as it ſhall chance to be continued.

That the *Earth* is more or leſs Hollow is made probable, by what is found every where in the Mountains, *viz.* Natural *Cavities* or *Chambers*, which the Miners of the *North* call *Self Opens*. Theſe they meet with frequently, ſome vaſtly great, and others leſs, running away with ſmall *Sinus*'s: And I doubt not, but upon diligent inquiry, a great Catalogue of ſuch might be had, diſcovered in the Memory of Man. Beſides, many there are, which are known to open to the Day, and to diſcover themſelves without Digging, as *Pools-Hole*, *Okey-Hole*, *&c.* Again, the great and ſmall Streams, which do ariſe from under the Mountains do evidence the *Hollowneſs*, and *Sinouſneſs* of them. Add to theſe that many *Sinus*'s are made in that Inſtant, and are continued by the Exploſion and Rending of the firſt Matter Fired; which may, and do very probably, cloſe again, when the Force of that *Exploſion* is over, but are ſufficiently open to continue the *Earthquake*.

That theſe *Subterraneous Cavities* are at certain times and in certain Seaſons full of *Inflammable Vapours*, the *Damps* in our *Mines* ſufficiently Witneſs, which Fired do every thing as in an *Earthquake*, ſave in a leſſer Degree.

Now, that the *Pyrites* alone (which is our preſent Task) of all the known Minerals, yields this *Inflammable Vapour*, I thing highly probable, for theſe Reaſons,

1. Becauſe no Mineral or Ore whatſoever is *Sulphureous*, but as it is wholly, or in part, a *Pyrites*: I have carefully made the Experiment in very many of the Foſſils of *England*, and I do find them all to contain Iron, wherever there is *Brimſtone*.

2. Becauſe there is but one Species of *Brimſtone*, that I know of, at leaſt with us in *England*: And ſince the *Pyrites* naturally and only yields it, it is but Reaſonable wherever *Brimſtone* is found, though in the Air, or under Ground in Vapour, to think that alſo proceeds from it. The *Sulphur Vive* or *Natural Brimſtone*, which is found in and about the *Burning Mountains*, is certainly the Effects of *Sublimation*, and thoſe great Quantities of it ſaid to be found about the Skirts of *Vulcano*'s, is only an Argument of the long Duration, and Vehemency of thoſe Fires. And though the *Sulphur-Vive* or *Rough Brimſtone*, as they call it, had from *Hecla* and *Italy* is Opake, and agrees not with the Tranſparent and Amber-like *Sulphur-Vive* of the Ancients; yet it does not follow, that that alſo was not produc'd by *Sublimation*, no more, than that the *Stalactites*, or Water wrought Stone, is not ſo made, for that ſome of it is Opaque and ſome Chryſtalline.

But poſſible the *Pyrites* of the *Vulcano*'s or *Burning Mountains*, may be more *Sulphureous* than ours. And indeed it is plain, that ſome of ours in *England* are very Lean, and hold but little *Sulphur*; others again very much. And this may be one Reaſon, why *England* is ſo little troubled with *Earthquakes*, and *Italy*, and almoſt round the *Mediterranean-Sea* ſo very much. Another Reaſon is, the Paucity of *Pyrites* in *England*; where they are, indeed, ſome little in all Places, but moſtly *Sparſim*; and if perchance in *Beds*, thoſe are comparatively thin, to what probably they are in the *Burning Mountains*, as the vaſt Quantity of *Sulphur* thence *Sublim'd* doth ſeem reaſonably to Imply. Alſo, if we compare our *Earthquakes*, and our *Thunder* and *Lightning* with theirs; there it *Lightens* almoſt daily, eſpecially in Summer time, here ſeldom; their *Thunder* and *Lightning* is of long Duration, here ſoon over; there the *Earthquakes* are frequent, long, and Terrible, with many *Paroxiſms* in a Day, and that for many Days, here very ſhort, a few Minutes and ſcarce Perceptible. To this Purpoſe, the *Subterraneous Cavities* in *England* are ſmall, and few compar'd to the vaſt Vaults in thoſe Parts of the World; which is evident, from the ſudden Diſappearance of whole Mountains and Iſlands.

There are indeed other *Inflammable* Minerals beſides the *Pyrites*: But by the Providence of God not to be found in *England*, that I know of, and not in any Quantity in any Place of the Word, that I can Learn; Which is well for Mankind, becauſe they are very *Poyſons* as the *Orpiments*; but they are Specifically Diſtinct from *Brimſtone* which no *Ore* yields but Iron; ſo the *Orpiments* are all *Gold Ore*. And by the bye, ſome Authors have aſſign'd this as a good Reaſon, againſt any Medicine, that ſhall be made out of *Gold* (as fond as we are of an *Aurum Potabile*) as having naturally a Deleterious Quality.

It may be objected that no Body is *Kindled by it ſelf*: But it ſeems to me apparently otherwiſe; for that *Vegetables* will heat and take Fire of themſelves, as in the frequent Inſtance of Wet Hay; And *Animals* are naturally on Fire, and Man doth then ſufficiently Demonſtrate it, when in a Fever: And amongſt *Minerals*, the *Pyrites*, both in Groſs and in Vapour, is actually of its own Accord Fir'd. Dr. *Power* has recorded at large, in his *Micrographia* a famous inſtance of it; and the like not very larely happens. And that *Damps* Naturally Fire of themſelves, we have the general Teſtimony of *Miners*, and the ſame *Author*.

Again, the *Vulcano*'s, all the World over, Argue as much; for we, with great Probability, believe them to be Mountains made up in great part of *Pyrites*, by the Quantities of *Sulphur* thence *Sublim'd*, and the Application of the *Loadſtone* to the *Ejected Cinder*. I go further.

That theſe *Vulcano*'s were *Naturally Kindled* of themſelves, at or near the Creation is Probable: Becauſe there is but a certain known Number of them which have all continued Burning beyond the Memoirs of any Hiſtory; few or none of them that I know of, have ever totally decay'd or been Extinct, unleſs poſſibly by the *Submerſion* of the Whole, being Abſorpt in the Sea. Though they indeed, do Burn more Fiercely ſometimes than at others for other Reaſons. So that it ſeems to me as Natural to have *Actual Fire* in the *Terreſtrial* World from the Creation, as to have Sea and Water.

Again if theſe *Vulcano*'s did not *Kindle of themſelves*, what Cauſe can we imagine to have done it. If the Sun; we anſwer, *Hacla* placed in ſo Extream Cold a Climate was *Kindled*; for ought I can ſee by the Natural Hiſtory of both, as ſoon as *Ætna* or *Fuegos*, or the moſt Southerly.

Not the Accidents happening from Man; for, if Man was (as we muſt believe) created Solitary and Topical, they were none of his Kindling, becauſe they ſeem to be Fired before the World could be all over Peopled: Beſides, they are moſtly the very Tops of vaſt high Mountains, and therefore the moſt unfit for the Habitation of Man.

If we ſay *Lightning*, and *Thunder*, or *Earthquakes*; we beg the Queſtion: For the Cauſe of the one is the Cauſe of the other; and they are one and the ſame. It remains therefore (very probable) that they were *Kindled of themſelves*.

I for my part know no Subject in the whole Mineral Kingdom ſo general and Laſting for the Fuel of theſe Mountains, as the *Pyrites*; which I have ſaid alone does yield *Sulphur*, and Naturally Reſolves it ſelf into it, by a kind of Vegetation.

About the *Durable Burning* of the *Pyrites* theſe are Inſtances *Scotch Coal* hath leſs of the *Pyrites* in it, being moſtly made up of *Coal Bitumen*, and therefore it Burns and Conſumes Quickly, and leaves a White Cinder. Sea-Coal, or that Coal which comes from *Newcaſtle* by Sea to us, and for that Reaſon ſo called, Burns ſlowly ; and the *Sunderland* Sea Coal ſo ſlowly that it is ſaid, by Proverb, to make Three Fires ; this hath much *Pyrites* mixt with it, and Burns to a Heavy Reddiſh Cinder, which is Iron, by the *Magnet*. But I have ſeen, and have a Specimen by me of a Coal from *Ireland*, (the Proprietor of the Pits is Sir *Chriſtopher Wandsford)* which is ſaid to be ſo laſting, that it will continue 24 Hours Red Hot, and almoſt keep its Figure: This ſeems to be in great part *Pyrites* by the Weight and Colour.

Subterraneous Cakes *in* Someſet-ſhire, *By Dr.* I. Beal. n. 18. p. 323.

XXIII. In the *Moors* from *Yeovil* towards *Bridgewater*, in the extreame Drought we have endured this Summer 1666, ſome Lengths of Paſture grew much ſooner withered and parched than the other Paſture. And this Parched part ſeemed to bear the Length and Shape (in groſs) of Trees. They digg'd and found in the place, Oaks indeed, as Black as *Ebony*. And hence they have been Inſtructed to find and take up many Hundreds of Oaks.

Wood *found* Under ground *in* Lincolnſhire, *By* . . . . n. 67. p. 2030.

XXIV. In that *Fenny Tract*, called the *Iſle of Acholme*, lying part in *Lincolnſhire*, and part in *Yorkſhire*, has been abundance of Oak, Firr, and other Trees, of late frequently found in the *Moore* ; whereof ſome Oak are 5 Yards in Compaſs, and 16 Yards long ; others ſmaller and longer, with good quantities of *Akorns* near them, lying ſomewhat above 3 Foot in Depth, and near their Roots, which do ſtill ſtand as they grew, *viz.* in firm *Earth* below the *Moore*. The *Firrs* lie a Foot or 18 Inches Deeper, more in Number than *Oak*, and many of them 30 Yards long, one of them being, not many Years ſince, taken up of 36 Yards long beſides the Top, lying alſo near the Root, which ſtood likewiſe as it grew, having been Burnt and not cut down ; as the Oak had been alſo. Mr. *Dugdale* concludeth that this *Moore* hath been ſo for divers Hundreds of Years, and that the Cauſe thereof has been the Muddineſs of the *Tides*, which flowing up *Humber* into *Trent*, left in time ſo much Filth, as to Obſtruct the Currents of *Idle*, *Dun*, and other Rivers, which thence flowed back and Overwhelmed that Flat Country.

Of Draining the Fenns.

Foſſile Wood *near* York; *By Dr.* Richardſon. n. 228. p. 526

XXV. At *Youle* about 12 Miles below *York*, near the place where the *Dun* empties it ſelf into the *Humber*, there are ſeveral Perſons which are call'd *Tryers*, who, with a long piece of Iron, ſearch in the ſoft and Boggy Ground for *Subterraneous Trees* ; and by this way of Tryal, can in a great Meaſure, diſcover the Length and Thickneſs of theſe Trees, and get a Livelyhood by it. Some are ſo large, that they are uſed for Timber in Building Houſes, which is ſaid to be more Durable than *Oak* it ſelf, others are ſplit into *Laths* ; others are cut into long *Chips*, and tied up in Bundles, and ſent to the Market Towns ſeveral Miles off, to light Tobacco. Thoſe that I viewed, were all Broken off from the *Roots*; I ſuppoſe by violence of Storm or Water, or both; and upon enquiry do find, that they are all after the ſame manner. Theſe *Tryers* do affirm, that at three or four Yards deep they find *Stumps* of *Trees* broken off; ſome two, three or four Foot from the Ground, and to be exactly the ſame Wood with the *Subterraneous Trees*. The *Bate* or Texture of this Wood is the ſame with *Firr*, eaſily *Splitting*: If Burnt it ſends out the ſame *Reſinous ſmell*, and it affords the ſame Coal. The Branches generally grow in Circles, as the Knots do Teſtifie: The Knots do eaſily part from the reſt of the Wood, as is uſual in *Firr-wood*. The Straightneſs and Length of theſe *Trees*, are alſo a Preſumption, that they muſt be ſuch; if one conſider that ſome of theſe are nigh 100 Foot Long; and at the Bottom, not much above a Foot in Diameter. They affirm'd to me, that their Tops lay all one way, (*viz.*) with the Current of the Water. There are alſo *Oaks* found there, though not in ſo great Quantity. The *Vitriolick* parts of the *Earth* (in which they have lain, hath given them a Black Tincture quite through, which (when Wrought and Poliſhed fine) is not much inferiour to *Ebony*. This Wood doth not emit the ſame Smell when Burnt, with that call'd *Firr-wood*; therefore I hope the Smell of that Wood will not be attribute to the *Bituminous* parts of the *Earth* in which it hath lain. About 60 or 70 Years ago, ſeveral *Dutchmen* undertook to *Drain* a large Marſh in that place; and in cutting a Channel in the dry Ground betwixt the *Fen* and the River, at the firſt they threw up a *Rich* and *Firm Soil*, afterwards they met with a Stratum of *Sand*, under that a Stratum of *Boggy* Ground in which they found of theſe *Subterraneous Trees*, and under that *Firm* Ground; and a Gentleman atteſted unto me, who had it from ſeveral Perſons then living, that were Eye-Witneſſes, that the *Firm* Ground in ſome Places lay *Ridge* and *Furrow*. There are ſeveral of theſe *Roots* of *Trees* to be ſeen in the Channel at Low-Water to this Day, and yet there are neither *Firr* nor *Pine* growing naturally here, nor have been in the Memory of any Man; neither doth there remain any Tradition of the Growth of any ſuch.

Foſſile wood in Craven; *By Dr. M. Liſter*, n. 224. p. 381.

XXVI. *Pimco* is one of the higheſt Mountains in *Craven* in *Yorkſhire*, lying on the Southſide of that Country, ſome two Miles above *Carleton*. On the Southſide of the *Pike*, (as they call the very Top of that Mountain) is a place where the *Water* ſtands; this is called a *Moſs*, and is ſome Fathoms perhaps deep in black Mud. Here are dug up, if we will believe the Inhabitants, not only *Roots*, but whole *Trees* of *Firr*.

I ſaw there no ſmall Marks of a Wood in former Ages; as the *Roots* or *Stumps* of *Trees* appearing above ground; which upon due examination of the Grain and Bark, I found to be the *Roots* of *Birch*. Theſe *Roots* ſplit eaſily and ſome dry, and when dryed they burn with a *Laſting Flame*; and for this purpoſe they uſe them upon any ſudden Occaſon about their Houſes. And altho' the *Flame* be great yet it is without any *Reſinous ſmell*: However, it ſeems, that their having lain ſo long under Ground has prepared the Juice for *Burning*. There have been *Oaks*, as I have been told, dug up hereabouts alſo, but I ſaw none.

XXVII. On the South-ſide of *Mendipp-Hills*, at a place call'd *Doulton*, there are great Quarries of *Free-ſtone*, where the Workmen at Five or Six Fathom deep, Sawing Stones of Four or Five Tun Weight, have often found large pieces of Cleft and Fair Oak in the midſt of them.

Wood *found in* Stone *by* Mr. J. Beaumont. *Ph. Col.* n. 2. p. 6.

XXVIII. *S. Septali*, in a Voyage he made a few Years ſince over ſome Mountains to *Genoa*, met with ſome Peaſants who digging on the ſides of an Hill, had found and gathered very many *Cockle-Shells* of divers kinds, which he wonder'd at, and therefore went to the very place; where he was ſatisfied of the Truth of the Relation, finding great ſtore of different *Shells*, as the *Turbinets*, *Echini*, and ſome *Pearl-Shells*, whereof one had a fair *Pearl* in it.

Foſſile Shells *in* Italy; *By* S. Manfredus Septalius. n. 27 p. 493

XXIX. Upon the Way of *Beziers* to *Narbonne*, in a place pretty large, raiſed by Eſtimation above the *Level* of the *Sea*, (which is two Leagues diſtant from it) about 15 or 16 Fathoms, I ſaw Rocks, which incloſed a good number of big *Oyſters Petrefied*: And upon the ſame Way above the place, which is called *Nice*, at the higheſt place of the Deſcent, very Cragged, where the Rock is cut to make a paſſage, is ſeen a Bed two foot large, of many *Cockle-ſhells Petrified*, heaped up, as ordinarily they are on the Sea-ſhore; which notes ſufficiently, that the Sea formerly covered this Place.

Foſſile Shells *in* France, *By* M. de Martel. n. 58. p. 1183

XXX. We will eaſily believe (what I have Read in *Steno*'s *Prodromus*) that all along the Shores of the *Mediterranean Sea*, there may all manner of *Sea-ſhells* be found promiſcuouſly included in *Rocks* or *Earth*, and at good diſtances too from the Sea. But for our *Engliſh* Inland *Quarries*, I am apt to think, there is no ſuch matter, as *Petrefying* of *Shells* in the buſineſs: but that theſe *Cockle-like Stones* ever were as they are at preſent *Lapides ſui generis*, and never any part of an *Animal*. It is moſt certain that our *Engliſh Quarry ſhells* (to continue that Abuſive name) have no Parts of a Different Texture from the *Rock* or *Quarry* where they are taken, that is, that there is no ſuch thing as *Shell* in theſe *Reſemblances* of *Shells*, but that *Iron-ſtone Cockles*, are all *Iron-Stone*; *Lime* or *Marble*, all *Lime-ſtone* or *Marble*; *Sparre* or *Chryſtalline Shells*, all *Sparre*, &c. and that they were never any Part of an *Animal*. My reaſon is: That *Quarries* of different *Stone* yield us quite Different ſorts of Species of *Shells*, not only one from another (as thoſe *Cockle-ſtone* of the *Iron-Stone-Quarries* of *Allderton* in *Yorkſhire*, differ from thoſe found in the *Lead-Mines* of the Neighbouring Mountains, and both theſe from that *Cockle-Quarry* of *Wansford Bridge* in *Northamptonſhire*, and all three from thoſe to be found in the *Quarrers* about *Gunthrop* and *Beavour-Caſtle*, &c.) but, I dare boldly ſay, from any thing in Nature beſides, that either the *Land* or *Salt*, or *Freſh Water* doth yield us. 'Tis true that I have pick'd out of that one *Quarry* of *Wansford* very reſemblances of *Murices*,

Foſſile Shells *in ſeveral Places of* England; *By Dr.* M. Liſter. n. 76. p. 2282

Murices, *Telinæ*, *Turbines*, *Cochleæ*, *&c.* and yet I am not convinced, when I particularly examined ſome of our *Engliſh Shores* for *Shells*, alſo the *Freſh Waters* and the *Fields*, that I did ever meet with any one of thoſe *Species* of *Shells* any where elſe but in their Reſpective *Quarries*, whence I conclude them *Lapides ſui Generis*, and that they were not caſt in any *Animal* Mold, whoſe Species or Race is yet to be found in being at this Day. I have two or three ſorts of our *Engliſh Cockle-Stones* of different *Quarries*, nearly reſembling one the other, and all of them very like a common ſort of Sea ſhell; and yet there is enough in them ſpecifically to diſtinguiſh them, and hinder them from being ſampled by any thing of the Spoils of the Sea or Freſh Waters, or the Land-Snails.

Foſſile Shells in Kent, By Dr. Griff. Harley. n. 155. p. 463.

XXXI. At *Hunton*, 5 Miles from *Maidſtone* in *Kent*, and about a quarter of a Mile from the River *Medway*, after the Coping of a piece of Ground, was taken off, (which was of a Clay about 3 Foot deep) we came to a very good *Blew Marle*, which continued ſuch 3 Feet and a ½ deep more; and then there appeared a Hard Floor or Pavement compoſed of Shells, or Shell like Stones, crowded cloſely together; the Interſtices whereof were filled up with the ſame *Marle*. This Layer (which runs as the Veins of Flints do in Chalky *Earth*) was about an Inch deep, and ſeveral Yards over, and we could walk on it as on a Bench; under this Layer we came to *Marle* again. I cannot upon Inquiry, find that in the Memory of any Man thereabouts, any Floods from the River have reached ſo far as this place.

The Stones, (for I take them to be *Lapides ſui Generis*) are of that ſort which is call'd *Conchites*, and reſemble *Sea Fiſh* of the *Teſtaceous* kind; moſt of them are *Turbinated*, or Wreathed, the reſt are of the *Bivalvular* ſort, but I have not found any of them with *Valves* cloſed together, but Single.

The bigneſs of the *Turbinated*, is from a *Vetch* to a Haſſel Nut, they are fill'd with a *Terra Lapidoſa*, like the *Marle*, and are of that Colour till you have Waſhed and Rubbed them, and then they appear of the Colour of *Bezoar*, and of the ſame Politure. After they have been boiled in Water, they are Whitiſh, and leave a Chalkineſs upon your Fingers, which when it is rubbed off, gives you a view of very fine Black *Striæ*, thick ſet on the outſide. Theſe *Wreathed Stones* are all perfectly formed, they differ not in Figure one from another, but that ſome have their ſides a little depreſſed; upon a few of them there Adhered a little proportion of a Glittering Mineral like Iron. In *Vinegar*, they made a ſtrong and a Boiling *Efferveſcence*.

The *Bivalvular* are moſt of them no bigger than a Kidney Bean, ſome leſſer, a few as broad as the largeſt ſort of Beans, but the *Valve* much thinner than any of that kind, which had been the *Exuviæ* of an *Animal*, the Gibbous part of the *Valve* is Smooth, and of the ſame Colour with that of the *Turbinated*. In a few there are ſome Oblong Lineations bent Circularly to the Commiſſure of the *Valve*: I have a piece of ſuch an one by me, conſiſting of ſeveral *Lamellæ*, which hath this further obſervable in it, that the Gibbous part is of a moſt beautiful Black ſhining Colour, and the Inner part of a ſhining Pearl Colour'd Subſtance.

Of this *Bivalvular* ſort, many of them ſeem to be *in fieri*, not as to their Shape, but as to their Hardneſs and thickneſs, there being in ſome only the *prima ſtamina*, and in others the ſeveral Steps and Progreſſes toward a perfect *Figuration*, which ſeems to me an unanſwerable Argument, for their never having been the *Spoils* of *Animals*. Some of theſe appeared in the Inner ſide White, and it came off upon the Fingers like Chalk, and ſeemed as if a Depreſſion had been firſt made in the Bed of the Shape of a *Valve*, and then the Convex ſide rubb'd with Chalk or painted White.

Thoſe Pieces of this odd *Concretion*, which I keep by me (now the *Marle*, which is in the Interſtices, is grown hard) appear much like that Courſe ſort of *Marble-Stone*, which is dug about *Pluckley* in the *Wild* of *Kent*. Which *Marble* ſeems to be a *Coagmentation* of ſuch *Shell-like Stones*, the *Marle* betwixt them having acquired a firm Solidity and Hardneſs. With this *Stone* they make their Cauſeys in that part of the Country; and they are apt to be worn into little Cavities, or Holes, where they have lain long expoſed to the Air; the Rains, in length of time, Waſhing away the portions of *Marle* (which is leſs hard than the reſt) from the Orifices and Interſtices of thoſe *Shell-like Stones*. I am much confirmed in this Opinion by a piece of *Marble*, inlaid, as it were, with ſuch *Stones*, which was dug out of a Marle Pit, at a little diſtance from, and on the ſame level with that at *Hunton*.

The Imperfect as well as the Complete Formation of ſome of the *Bivalvular* kind (the *Valves* being only found ſingle; and both ſorts in a Ground never heretofore diſturbed) are no Light Arguments for their being *Stones*. Perhaps the Salts of Plants or Animal Bodies, waſhed down with Rains, and lodged under Ground, may be there diſpoſed into ſuch like Figures, as well as above it:

Vid Muſ. Reg Societ. part. 3, Cap. 1.

XXXII. Near *Reading* in *Barkſhire*, for many ſucceeding Generations, a continued Body of *Oyſter-Shells* has been found through the whole Circumference of 5 or 6 Acres of Ground. The Foundation of theſe Shells is a hard Rocky Chalk, and above this Chalk the *Oyſter-Shells* lie in a Bed of Green Sand upon a Level, as nigh as can poſſibly be judged; this *ſtratum* of Green Sand *Oyſter-ſhells* is (as I meaſur'd) nigh two Foot deep. Now immediately above this Layer, or *ſtratum* of Green Sand and *ſhells*, is a Bed of a Bluiſh ſort of Clay, very Hard, Brittle and Rugged, they call it a Pinny Clay, and is of no uſe. This Bed, or Layre of Clay, I found to be nigh a Yard deep; and immediately above it, is a *ſtratum* of *Fuller's Earth*, which is nigh two Foot and a half deep; this *Earth* is often made uſe of by our Cloathiers: And above this *Earth* is a Bed or Layre of a Clear, Fine White Sand, without the leaſt Mixture of any *Earth*, *Clay*, &c. which is nigh 7 Foot deep: Then immediately above this is a ſtiff Red Clay, (which is the uppermoſt *ſtratum*) of which we make our Tiles. The depth of this cannot be conveniently taken, it being ſo high a Hill, on the top of which hath been, and is dug up a little Common *Earth* about 2 Foot deep.

Foſſile Shells; *In* Barkſhire; *By* Dr. Ja. Brewer. n. 26. p. 464.

I have, with a Mattock, dug out ſeveral whole *Oyſters* with both their *Valves*, or *Shells* lying together, as *Oyſters* before opened: In their Cavity there is got in ſome of the formentioned Green Sand. Theſe Shells are ſo very Brittle, that in digging for them, one of the *Valves* will frequently drop from its Fellow; but 'tis plainly to be ſeen that they were United together, by placing the Shell that drops off to its *Fellow Valve*, which exactly Correſponds: But I dug out ſeveral that were *Entire*; nay, ſome *Double-Oyſters* with all their *Valves* United.

Foſſile-ſhells and Fiſhes in Lincolnſhire, By Mr. Abr. de la Pryme. n.266.p.678

XXXIII. In a *Quarry* at the Eaſt End of *Broughton* in *Lincolnſhire*, they get a Clayie Subſtance or *Earth* that lies under the Stone in which are innumerable Fragments of the Shells of Shell Fiſh of various ſorts, of *Pectinites*, *Echini*, *Chonchites*, and others, with ſome Bits and Pieces of *Cornel*, and there are ſometimes found Whole Shell-Fiſh, with their Natural Shells on, in their Natural Colours, moſt miſerably Crack'd, Bruiſed and Broken, and ſome totally ſqueez'd Flat by the great Weight of the *Earth* that yet lies, and that was caſt upon them in the *Noachian Deluge*.

There is another *Quarry* in the Field on the South ſide of the Town, of a Hard Blue Stone, which was moſt certainly a pure fine Blue Clay in ſome *Antediluvian Lake*, in the Stones of moſt of which are innumerable *Petrefy'd* Shell-Fiſh of various ſorts, but ſo United to the Stone, that it is very difficult to get them whole out, and I have always found that they lie in the Superficies of the *Quarry*, within a Foot of the Top thereof, and few or none deeper therein. In many Places of the Surface of the *Quarry*, (which looks Rugged and Drifted, as Snow does after a Storm, and by which one may find what Quarter the Storm or Wind was then in;) there are many Shell Fiſh half in the Stone, half out. That part which is within the *Quarry* is entire and whole, but a hard Stone, and that part which is without, which the *Petrefick Effluviums* did not Touch, is conſumed and gone, all but a little of the Edges which are plain Shell, and have all the *Radii* and *Striæ* on them that the Common Shells of thoſe ſorts of Fiſhes have.

All theſe Fiſhes have their Shells on, ſome of which Shells are exceeding thin, to what otherſome are. Sometimes the Shells of ſome of them are in their *Petrefaction* ſo throughly United unto and Incorporated with the Stone, that they are ſcarce Viſible. Others in the ſame *Quarry* have a thick White Shell on them *Petrefy'd*, but not incorporated and Turned into the Subſtance of the Bed in which they lie. As you get that Fiſh out, all the Shell ſticks ſo faſt to the Rock, that moſt commonly it is left behind, but ſometimes the Shell Cleaves in two, one half of the Shell on both ſides of the Fiſh ſticks thereto and the other half to both ſides of the Bed, but others come out by lying in the Air in Froſty Nights, with the whole *Natural ſhell* on them, and the *Radii* or *Striæ* very exact. Other Fiſh there are here, that have a black ſmooth Shell on them, with ſeveral *Striæ* but no *Radii*, very like if not the ſame with the *Concha Nigra Rondel.*

I have alſo ſeen in this *Quarry* ſome *ſhell-fiſh* half open and fill'd with the Matter of the Bed in which they Lie, and *Petrefy'd* with it. Others being in Heaps together, I have found ſome of them Broken, others Bruiſed, and the Edges of one Fiſh thruſt into the ſides of another, ſome with the one *ſhell* thruſt half way over the other, *&c.* and ſo *Petreſy'd* in the Bed together. Others in the ſame Bed have been ſo Cloſe, that the Matter of the Bed could not inſinuate it ſelf into them. Theſe that are thus found, are ſome of them totally Empty, others are filled with *Criſtalline Fluors*, others I have ſeen half full of the ſaid Blewiſh Clay of the Bed, and half full of the ſaid *Criſtallizations*, which have ſtuck therein, from nothing but *Subterraneous Heats* and *Effluviums*.

Amongſt theſe Fiſh in this *Quarry*, I have ſeen ſeveral great *Horſe-Muſcles*, ſuch as breed in *Freſh-Water-Rivers* and *Ponds*, which are exactly like the *Concha Longa Rondel*, but are more thick, full, and pubble, than ours commonly are at this Day; which greatneſs and largeneſs proceed from nothing but the Fertility and Fatneſs of the Bed on which they Bred; and at this Day in an old Pond beyond *Broughton-Hall*, there are ſome of the largeſt of this ſort of *ſhell fiſh* that ever I ſaw, as if this Soil agreed better to the breeding of this ſort of Fiſh than any elſe, juſt as the *Cornu Ammonis*, *Nautili*, and others Breed beſt upon *Alum Soils*: And that is the Reaſon that they are found ſo much at *Whitby*, *Rochel*, *Lunenburg*, *Rome*, and other Places, where are Famous *Alum-Mines*. And if any one would find any of thoſe ſorts of Fiſhes (which ſome Learned Men have Ridiculouſly thought to be Species totally loſt) they ought in all Probability to ſeek for them upon *Alum Soils* in the Sea, and there they would undoubtedly find them.

Others love an *Oazey* Soil, a ſort of a Confuſed Mixture of ſeveral Soils together, as part of the Country about *Frodingham*, *Bramber*, *Aſhbee*, *Botſworth*, *&c.* ſeems to be, in the Fields and Stones of which Towns is one particular ſort of Fiſh, which I know not what *Genus* or *Species* to compare to, bending ſomewhat like a *Ram*'s *Horn*, and exactly Creaſed like one on the out-ſide with an *Opuſculum* thereon, which the Fiſh opened and ſhut as it had Occaſion. The Bed whereon the ſaid *Shell-Fiſh* Bred in the *Antidiluvian Sea*, is not over a Foot Thick (to the beſt of my Memory) in all which, but for the moſt part in the Superficies thereof, are Millions of the ſaid Fiſh ſticking half within the Stone, half without; which *Shell-Fiſh* having a moſt durable Shell, that part which ſticks out of the Stone, is not conſum'd, as in the *Shell-Fiſh* of *Broughton*, but remains Whole and Entire. And yet I have ſeen and found whole Lumps of them, that by ſome Huge Weight caſt or fallen upon them, in the *Noachian Deluge*, have been miſerably Broken and Shattered in pieces, and ſo *Petreſy'd* in the Bed as they lay.

In the Pariſh of *Broughton* aforeſaid in the looſe *Earth* above the aforeſaid Blue *Quarry*, and elſewhere, I have found in a Whitiſh Stone, the *Echini Galeati Puncticulati Lluydii*, the *Turbinites Major Lluydii. Tab.* 7. *N.* 341. the *Coclites. Lævis Vulgatior. Lluydii. T.* 7. *N.* 322; in Blue Stone, the *Concha altera Longa Rondeletii*, exactly agreeing to the Picture and bigneſs thereof in *Geſner de Piſcibus. p.* 231. only the *Nek* in much longer: I have found alſo multitudes of *Belemnites*, great and little, Perforated and Flat at the Root, by which they grew in the *Antidiluvian Sea*, unto ſome of which I have found little Shell-Fiſh Sticking.

There have been many Conteſts and Diſputes amongſt the Learned concerning theſe Appearances; but my Notion of them is, that the *Antidiluvian World* had an External Sea as well as Land, and Mountains, Hills, Rivers, and Fruitful Fields, and Plants; that it was about the bigneſs that our Earth is at preſent of; and that when God had a Mind, for the Wickedneſs of the Inhabitants that Dwelt thereon, to Deſtroy the ſame by Water, he broke the Foundations and Subterraneous Caverns and Pillars thereof, with moſt dreadful *Earthquakes*, and cauſed the ſame to be for the moſt part, if not wholly *Abſorb'd* and ſwallow'd up, and Covered by the Seas that we now have, and that this Earth of Ours Riſe then out of the Bottom of the *Antidiluvian Sea* in its Room; juſt as many Iſlands are ſwallowed up, and others thruſt up in their ſtead.

From this Happy Syſtem of the *Deluge*, which is the moſt Concordant to the Scriptures of all others, all thoſe things are eaſily Solved that were Hard and Difficult before. It is no longer a Wonder that Shells, and Shell-Fiſh, and the Bones of other Fiſhes and Four Footed Creatures, and Fruits, *&c.* are found (as they commonly are) in Beds and *Quarries*, in Hills and Mountains, and in the Bowels of the Earth; for here they Bred in the *Antidiluvian Sea*, thither they were Elevated with the Hills and Mountains in the Time of the *Deluge*, there they Fell into, were Abſorb'd, and Bury'd, in Chaſms, and Holes, and Clefts that would neceſſarily happen in the Thruſting up of the Earth, and are found in the Soil that was Flung and carried with wonderful Violence and Confuſion from one place to another, by the working of the Waters, and the Ferment and Hurry that they were put into.

And as all Countries were thus Raiſed out of the Bottom of the *Antidiluvian Sea* and *Lakes*, ſo that part of the Country about *Broughton* aforeſaid, appears manifeſtly in the *Antidiluvian World* to have been the Bottom of ſome *Freſh-Water Lake*, becauſe that thoſe are Freſh-Water Shell-Fiſh that are found there, and the Bed upon which they Bred, was a Fine Blue Clay, which is the Colour of the Stone to this Day: Which Bed being *Elevated* and lifted up (and Daſhed over with other Earth in the Workings of the Waters, and the great Hurry and Confuſion that then happened) the ſaid Bed by the Power of the *Subterraneous Elevating Heats, Steams* and *Effluviums* was turned by Degrees into Stone with all the Fiſhes therein.

I have before told you, that ſome of the Shell Fiſh in the ſame Bed, are full of the Matter of the Bed, but of *Fluors*, tho' ſuch are not very common: Some might wonder, ſeeing that the Shells are cloſed, that the Matter of the Bed could Inſinuate it ſelf into them; but that is nothing but what is common in like Caſes, for I have frequently ſeen in the Bottoms of Ponds and Rivers, where ſuch Shell-Fiſh in plenty are, that when the Fiſh is Dead and Conſumed, and the Shell in the Mud, with the Edges as Cloſe as if the Fiſh was Alive that nevertheleſs the Mud or Clay will by Degrees inſinuate and Fill the ſame; and now if the Bottom of any one of the ſaid Rivers or Ponds was Raiſed by *Earthquakes*, and Turned into Stone by *Petreſick Effluviums*, they would exactly be found as theſe are.

That many *Shell-Fiſh* ſuffered ſuch wonderful great Violence and Force in the ſaid great Flood, in ſo much as to be Cruſhed, and Bruis'd, and ſqueez'd Flat, as ſome of thoſe manifeſtly are, is likewiſe nothing Strange or Wonderful, if we do but conſider the great pieces of Riſing Rocks, and Hills, and Mountains, that muſt needs roll down, and fall, in ſuch a general Hurry and Confuſion as that muſt needs have been in the *Quarry*, at the Eaſt end of this Town of *Broughton* : Where Fragments of Innumerable Shells are found, and ſome *ſhell-fiſh* ſqueezed flat, all which are Natural, and not Petrefy'd. There was in the *Deluge* Flung upon the ſame a Huge Bed of a Mix'd confuſed Subſtance, now turned into a Whitiſh Soft Cancker'd Stone, and upon that were caſt vaſt Quantities of *Earth*, all which Weigh'd and Preſſed the tender Shells ſo much, that they ſqueez'd ſome Flat, and broke others to Pieces, as we find them to be at this Day.

I have a hard Stone, part of the aforeſaid Blue *Quarry*, with little Bits of *Wood-Coals* therein, and whole *Leaves* of *Vaccinia*, or *Whortle Berries*, ſuch as grow upon Heath very Exact : And Mr. *Llwyd* and others have given us ſeveral large Accounts of whole *Leaves* and *Plants* found in Stones and Rocks, and deep in the Bowels of the *Earth*, ſome Folded, ſome Plain, ſome Imperfect ; all which is very eaſily Solvable, having in that General Confuſion and Hurry been ſeized upon and embody'd in Lumps of Clay and other Matters, and others Catched and intercepted in Rolling Beds of *Earth*, as they Tumbled down from Riſing Hills and Mountains, and ſo Lodg'd deep in Chaſms of the Ground and Petrefy'd, and ſo Preſerv'd unto this Day.

Gloſſopetræ; *By Dr.* Liſter. n. 110. p. 223.

XXXIV. I have had out of the Iſle of *Sheppy* in the River of *Thames*, very *Sharks Teeth* dug up there; which could not be ſaid to be Petrefyed. They were ſomewhat Gilded with a *Vitriolick* Tarniſh at our firſt receiving them ; but they were White, and in a ſhort time came to their Natural Colour.

In the *Stone Quarries* in *Hinderskelf-Park* near *Malton* in *Yorkſhire*, I took out of the Rock my ſelf a Fair *Gloſſopetra* with three Points of a black liver Colour, and Smooth ; its Edges are not *Serrate* ; its Baſis is (like the *True Teeth*) of a Rugged ſubſtance ; it is Carved round the Baſis, with Imboſſed Work : It hath certain Eminent Ridges, or Lines like Rays, drawn from the Baſis to each Point.

The Foſſile Tongue *of a* Paſtinaca Marina ; *By Dr.* Hans Sloane. n. 232. p. 674.

XXXV. Dr. *Tancred Robinſon* received lately from *Maryland* a conſiderable Number of *Foſſile Bones* and *Shells* of ſeveral ſorts. Some of them had received little Alteration in the *Earth*, others more, and ſome were ſo Changed as to be Stony : But all of them Retained their Ancient Shape. One of theſe *Foſſiles* I compared with the Tongue of a Fiſh I had obſerv'd in *Jamaica*, and with another of the ſame Tongues in Pieces which I ſaw in Mr. *Charleton*'s moſt Uſeful and Admirable Collection of *Natural Curioſities*, and found a Perfect Agreement. Another of theſe *Foſſiles*

I ſuppoſe is the Upper *Mandible* or Palate of this Fiſh, which is Oppoſite to, or Anſwers this Tongue: The Agreement of this in all parts with the Tongue making it very likely to belong, if not to this ſame, yet to this kind of Fiſh.

A Part of one of the Joynts of this Tongue was dug up in *England*, and given to Mr. *Charleton*, by Mr. *Llwyd* of *Oxford*, by the Name of *Siliquaſtrum Subnigrum Pectinatum Maximum*.

Fig. 87, 88. Dr. *Robinſon* thinks the *Foſſile Palate* or *Mandible Fig.* 87 and 88. may be of the ſame kind with that taken Notice of by *Lachmund*, in his Book *de Lapidibus p.* 17. where 'tis call'd *Pentacrinos*.

Fig. 75. *Fig.* 75. Is the Whole Tongue of a *Flat-Fiſh* a-kin to a *Thornback*, which I call *Paſtinaca Marina, Lavis, Livida, Albis Maculis notata.* It is made up of many Bones (about 19 in this) which are each of them Crooked, their two ſides making an obtuſe Angle, ſuch as the ſides of the *Under-Mandible* of a *Man* does; the Uppermoſt ſides of theſe ſeveral Bones have *Furrows* and Pieces ſtanding together after the manner of the Teeth of a ſhort ſmall Toothed Comb, the Extant Ends of which Anſwer the like Parts in the Bones of the Upper Jaw of this Fiſh, between which and this Tongue the Food of this Fiſh is to be Cut, Torn, or Ground to Pieces.

Fig. 76. *Fig.* 76. Is the Underſide of the ſame Divided into ſeveral Pieces alſo, but having no *Furrows* or *Teeth*, as thoſe of the Upper-ſide have.

Fig. 77, 78, 79, 80. *Fig.* 77, 78, 79, 80. Shews the Joynts or Pieces of the ſame Tongue, Separated in ſeveral Poſitions of their Upper and Under ſides, to ſhew the Perfect Agreement is between the Pieces of the Tongue of the Fiſh taken lately from it, and thoſe taken out of the *Earth*, which are Figur'd in the like Poſitions. *Fig.* 81, 82, 83, 84, 85, 86.

Fig. 81, 82, 83, 84, 85, 86. Fig. 87. 88. *Fig.* 87, 88. Are the Upper and Under ſides of what, I ſuppoſe, is the *Upper-Mandible* or *Palate* of this *Fiſh*, which is Oppoſite to, and Anſwers this Tongue.

Mr. *Willoughby* and Mr. *Ray* call this Fiſh *Nari-Nari*; and I am apt to believe the Anonymous *Portugal*, whoſe Deſcription of *Brazil* is Publiſhed in *Purchas, Lib.* 7. *Cap.* 1. *p.* 1313. Means this, when he ſays there were Rays, *having in their Mouth two* Bones *breaking* Wilks *with them.*

Horns *of* American Deer *found under* Ground in Ireland; *by Dr.* Tho. Molineux. n. 227 p. 489.

XXXVI. I had lately an Opportunity of particularly Examining a compleat Head, with both it's Horns entirely Perfect, not long ſince dug up in *Ireland*, and given to my Brother *Will. Molineux*, as a Natural Curioſity, by Mr. *Henry Oſtorn*, that lives at a Place call'd *Dardiſtown*, in the County of *Meath*, about 2 Miles from *Drogheda*. This is the *Third Head* which hath been found by caſual Trenching in his *Orchard*; they were all Dug up within the Compaſs of an Acre of Land, and lay about 4 or 5 Foot *under ground*, in a ſort of *boggy ſoil*. The firſt Pitch was of *Earth*, the next 2 or 3 of *Turf*, and then followed a ſort of *white Marle*, whereby they were found.

I

I took the *Dimenſions* of this *Head* carefully, as follows, from the extream tip of the right *Horn*, to the extream Tip of the left *A B*, was 10 Foot 10 Inches; from the tip of the right *Horn*, to the Root where it was faſten'd to the *Head CD*, 5 *Foot 2 Inches*; from the tip of the higheſt Branch (meaſuring one of the *Horns* Tranſverſe, or directly acroſs the *Palm*) to the tip of the loweſt Branch *G F*, 3 Foot 7½ Inches. The length of one of the *Palms* within the Branches *G H*, 2 Foot 6 Inches; the Breadth of the ſame Palm, ſtill within the Branches, *I K*, 1 Foot, 10½ Inches; the Branches that ſhot forth round the Edge of each *Palm*, were 9 in Number, beſides the *Brow-Antlers*, of which the right *Antler D L* was 1 Foot 2 Inches in length, the other was much ſhorter; the *Beam* of each *Horn M* at ſome diſtance from the *Head*, was about 8 Inches in Circumference; at the Root where it was faſtened to the *Head*, about 11 Inches in Circumference; the Length of the Head from the back of the Scull to the tip of the Noſe, or rather the Extremity of the upper Jaw-bone *NO*, 2 Foot; the Breadth of the Skull where largeſt *PQ*, was a Foot. There were 2 *Holes* near the Roots of the *Horns* that look'd like *Eyes*, but were indeed large open Paſſages, near an Inch in Diameter in the *Forehead-bone*, to give Way to great Blood Veſſels, that here iſſue forth from the Head, and paſs between the Surface of the Horn, and the ſmooth hairy Skin that covers them whilſt they are growing, (which is commonly call'd the *Velvet*) to ſupply the *Horns* with ſufficient Nouriſhment, while they are ſoft, and till they arrive at their full Magnitude, ſo as to become perfectly hard and ſolid.

Theſe Veſſels, by Reaſon of their Largeneſs and great Turgency of the Humour in them, whilſt the Horn is ſprouting and pliant, make deep and conſpicuous Furrows all along the outſide of it where they paſs, which may plainly be ſeen after the Horn is bare and come to its full Growth, at which time all theſe Veins and Arteries, with the outward *Velvet* Skin, drying by the Courſe of Nature, ſhrivel up and ſeparate from the *Horn*, and the Beaſt affects tearing them off in great Stripes againſt the Boughs of Trees, expoſing his Horns naked, when they are throughly hardned, without any covering at all.

Such then were the vaſt *Dimenſions*, according to which the lofty Fabrick of the *Head* and *Horns* of this ſtately Creature was built: And yet it is not to be queſtion'd, but theſe ſpacious *Horns*, as large as they were, like others of the *Deer-kind*, were naturally caſt every Year, and grew again to their full ſize in about the ſpace of 4 Months. For all ſpecies of *Deer* yet known certainly drop their *Horns* yearly, which I conceive to proceed from the ſame cauſe, that *Trees* annually caſt their ripe Fruit, or let fall their withering *Leaves* in *Autumn*; that is, becauſe the nouriſhing *Juice*, ſay it is Sap or *Blood*, is ſtop'd and flows no longer, either on the account it is now deficient, being all ſpent, or that the cavous Paſſages which convey it, dry up and cool; ſo as the *Part* having no longer any *Communication* with, muſt of neceſſity by degrees ſever from the *Whole*; but with this Difference, that *Horns* by Reaſon of their hard material and ſtrong Compoſition, ſtick faſt to the *Head* by their Root 7 or 8 Months after all their Nouriſhment perfectly retires, whereas *Leaves* and *Fruit*, conſiſting of a much more tender ſubſtance, and a finer Texture of parts, drop ſooner from their native Beds where they grew, when once the Supply of uſual Nouriſhment is ſtopt. This Analogy that *Nature* obſerves in caſting the *Horns* of Beaſts, and dropping the Fruit of Trees, will appear much more evident to any one that will obſerve the end of a Stalk, from which a ripe *Orange* or any large Fruit, has been lately ſever'd, and the But-end of a caſt Horn, where it is faſten'd to the *Os Frontis*; for by comparing them together, he ſhall find ſo great a Congruity in the Shape of both, that 'twill be apparent Nature works according to the ſame *Mechaniſm* in one as in t'other.

Such another *Head*, with both the Horns entire, was found ſome Years ſince by one Mr. *Van Delure*, in the County of *Clare*, buried 10 Foot under ground in a ſort of *Marle*, and was preſented by him to the late D. of *Ormond*. In the Year 1691, Major *Folliot* told me, that digging for *Marle* near Town *Ballymackward* near *Ballyſhanon* in the County of *Farmanagh*, he found buried 10 Foot under plain ſolid Ground, a pair of theſe ſort of Horns. In the Year 1684, there were two of theſe *Heads* dug up near *Turvy*, within 8 Miles of *Dublin*.

Not long ſince a *Head* of this kind, with its *Horns*, was found near *Portumny*, ſeated on the River *Shannon*, in the County of *Gallaway*. Such a *Forehead* with 2 extraordinary *Beams* of theſe kind of *Horns*, may be now ſeen faſtened againſt one ſide of the *Common Hall* of his Grace *Michael* Lord Archbiſhop of *Ardmagh*'s Houſe here in *Dublin*; they are both imperfect and want their *Palms*, yet, by the vaſt Thickneſs and Length of the *Beams*, I judge when entire, they much exceed the ſize of thoſe I have given the Dimenſions of above. The *Primate* told me, they were found ſome where in the Province of *Ulſter*.

To theſe I might add many more Inſtances of the like; as thoſe found by the late Lord *Mountjoy*, near his Houſe at *Newton Stewart*, and thoſe kept at *Stockallen* in the County of *Meath*, for to my *Knowledge* within leſs than 20 Years, above 20, I might ſafely ſay, 30 pair of theſe ſort of Horns have been dug up in ſeveral places of this County, all found by Accident; and we may well ſuppoſe vaſt Numbers ſtill remain undiſcovered; but theſe may ſuffice plainly to ſhew, this Creature was formerly common with us in *Ireland*, and an *indigenous Animal*, not peculiar to any Territory or Province, but univerſally met with in all Parts of the Kingdom. We may alſo reaſonably gather, that they were a *Gregarious Animal*, as the *Naturaliſts* call them, or ſuch a ſort of Creature as affect naturally keeping together in *Herds*; as we ſee the *Fallow Deer* with us, and as 'tis reported of the *Elches* in *Sweden*, and the *Rain Deer* in the Northern Countries of *Europe*; for otherwiſe we cannot eaſily fanſie it ſhould happen, that three of their Heads ſhould be all found within the narrow Compaſs of one Acre of Ground.

That theſe and ſeveral others, and indeed I think I may ſay all that I have been particularly inform'd of, though dug up in far diſtant places of *Ireland*, ſhould be conſtantly found buried in a ſort of *Marle*, ſeems to me to intimate, as if *Marle* was only a Soil that had been formerly the outward ſurface of the Earth, but in Proceſs of Time, being covered by degrees with many Layers of adventitious Earth, has by lying under Ground a certain Number of Ages acquired a peculiar Texture, Conſiſtence, Richneſs or Maturity that gives it the Name of *Marle*. For of Neceſſity we muſt allow the Place where theſe *Heads* are now found, was certainly once the external Superfice of the Ground, otherwiſe it is hardly poſſible to ſuppoſe how they ſhould come there.

And that they ſhould be ſo deep buried as we at preſent find them, appears to have happen'd by their accidentally falling where it was ſoft low Ground; ſo that the Horns by their own conſiderable Gravity might eaſily make a Bed where they ſettled in the yielding Earth, and in a very long courſe of Time, the higher Lands being by degrees diſſolved by repeated Rains, and waſh'd and brought down by Floods, covered thoſe Places that were ſituated lower, with many Layers of Earth: For all high Grounds and Hills, unleſs they conſiſt of a Rock, by this means naturally loſe a little every Year of their height, and ſometimes ſenſibly become lower even in one Age; of which we may ſee ſeveral ſatisfactory Inſtances related by Dr. *Plot* in his *Natural Hiſtory* of *Staffordſhire*, *Chap.* 3. *Page* 113. As for all ſuch Heads that might chance to fall on high or hard Grounds, where they could not poſſibly be covered or defended, theſe muſt of Neceſſity rot, periſh and be deſtroyed by the Weather.

By what means this kind of Animal, formerly ſo common and numerous in this Country, ſhould now become utterly loſt and extinct, deſerves our Conſideration.

Some have been apt to imagine this, like all other Animals, might have been deſtroyed from off the Face of this Country, by the Deluge in the Time of *Noah*: But if we conſider what a fragil, ſlight and porous Subſtance theſe and the Horns of all *Deer* are, we cannot well ſuppoſe they could by any means be preſerved entire and uncorrupt from that *Flood*, now above 4000 Years ſince; and I have by me ſome of the Teeth, and one of the lower Jaw-bones of this Creature ſo perfect, ſolid, ponderous and freſh, that no one that ſees them can poſſibly ſuſpect they could have been in Nature ſo many Ages paſt: And therefore it ſeems more likely to me, this kind of Animal might become extinct here, from a certain ill Conſtitution of Air in ſome of the paſt Seaſons long ſince the Flood, which might occaſion an *Epidemick Diſtemper*, if we may ſo call it, or *Peſtilential Murren*, peculiarly to affect this ſort of Creature, ſo as to deſtroy at once great numbers of 'em, if not quite ruin the Species. For this Iſland may very well be thought neither a Country nor Climate ſo truly proper and natural to this Animal as to be perfectly agreeable to its Temper, ſince for ought I can yet learn, it neither is, nor ever has been an Inhabitant of any of the adjacent Kingdoms round about us. And beſides the three Heads abovementioned, found ſo cloſe to one another in the County of *Meath*, and the two near

Tirvy, ſeems not a little to countenance this Opinion, as if theſe Animals died together in Numbers, as they had lived together in *Herds*. To this purpoſe, *Scheffer* in his *Laponia*, ſpeaking of the *Rain Deer*, an Animal that agrees in kind with ours, tho' it be a quite different ſort of *Deer*, ſays, That whole Herds of them are often deſtroyed by a raging Diſtemper like a Plague, common among them; and that ſometimes they all die, ſo that the *Laplander* is forced to ſupply himſelf with new.

'Tis probable however, that ſome of them might have eſcaped this common Calamity: But theſe being few in Number, I imagine as the Country became peopled, and thickly inhabited, they were ſoon deſtroy'd and kill'd like other *Veniſon*, as well for the ſake of Food as Maſtery and Diverſion. And certainly theſe ſavage Ages of the World would not have ſpared the reſt of the *Deer Kind*, *Stags* and *Hinds*, *Bucks* and *Does*, which we ſtill have, but that theſe, being of a much ſmaller *Size*, could ſhelter and conceal themſelves eaſier under the Covert of Woods and Mountains, ſo as to eſcape utter Deſtruction.

And here I cannot but obſerve, that the *Red Deer* in theſe our Days, is much more rare with us in *Ireland*, than it has been formerly, even in the Memory of Man: And tho' I take it to be a Creature, naturally more peculiar to this Country than to *England*, yet unleſs there be ſome Care taken, to preſerve it, I believe in Proceſs of time, this kind may be loſt alſo, like the other ſort we are now ſpeaking of.

It remains that we enquire what *Species* of *Animals* it was, to which theſe ſtately *Horns* formerly belong'd. I know it is an Opinion generally receiv'd, that they belonged to the *Alche*, *Elche*, or *Elende*, and therefore are vulgarly call'd *Elche's Horns*: But I have ſeen a pair of *genuine Elche's Horns* brought out of *Swedeland*, and they differed extreamly both in *Figure* and *Size*, from theſe we have now deſcribed. They were abundantly ſmaller, and quite of another *Shape* and *Make*, not *palmed*, or broad at the End fartheſt from the *Head*, as ours, but on the contrary, broader towards the *Head*, and growing ſtill narrower towards the Tips End, the ſmaller *Branches* not iſſuing forth from both *Edges* of the *Horns* as in ours, but growing along the upper Edge only, whilſt the other *Verge* of the *Horn* was wholly plain without any *Branches* at all. The faithful *Geſner* ſpeaking of the *ſize* of them ſays, *Cornua ſingula Libras circiter duodecim appendunt, Longitudine fere duorum Pedum*: Whereas the *Horns* we find here in *Ireland* are near thrice that length, and above double that Weight, tho' dried and much lighter from their being ſo long kept. Moreover the *Elche*, as deſcribed by *Apollonius Menabenus*, who had ſeen many of them, is no larger than a middling Horſe. And Mr. *Duncombe* told me, when he was Envoy in *Sweden*, he had ſeen there above 100 *Elches* together in a Herd, and none of them above 5 Foot high. And if ſo, we cannot imagine a Creature of that ſmall Size, could poſſibly ſupport ſo large and heavy a Head, with ſo wide and ſpreading a pair of *Horns* as theſe we are ſpeaking of; conſidering that exact *Symetry*, and due Proportion of Parts, Nature obſerves in the Formation of all the larger and Perfecter ſort of Animals.

De Quadrup. c. 1.

But the Deſcription of that Lofty Horned Beaſt in the *Weſt-Indies* call'd a *Mooſe*, much better Agrees with our *Iriſh* Animal than that of the *Elche* does. This Animal I find deſcribed by Mr. *John Joſſelyn*, among his *New England* Rarеties in theſe Words: *The* Mooſe Deer, *Common in theſe Parts, is a very goodly Creature, ſome of them* 12 *Foot high,* (*in height,* ſays another Author more particularly, *from the Toe of the Forefoot to the Pitch of the Shoulders* 12 *Foot*; *in its full Growth much bigger than an* Ox) *with exceeding Fair* Horns *with Broad* Palms, *ſome of them two Fathoms or twelve Foot from the* Tip *of one* Horn *to that of the other.* This is 14 Inches wider than ours was. Another thus deſcribes the Manner of the *Indians* Hunting this Creature: *They commonly Hunt the* Mooſe, *which is a kind of* Deer, *in the Winter, and run him down ſometimes in Half, otherwhile a whole Day, when the Ground is covered with Snow, which uſually lies here four Foot deep; the Beaſt, very heavy, ſinks every ſtep as he runs, Breaking down Trees as big as a* Man's *Thigh with his* Horns; *at length they get up with it, and darting their Lances, wound it ſo, that the Creature Walks heavily on, till Tired and Spent with loſs of Blood, it ſinks and falls like a Ruined Building, making the Earth ſhake under it.* So that we have not the leaſt Reaſon to queſtion but theſe vaſtly large *Iriſh Deer* and the *American Mooſe*, were certainly one and the ſame ſort of Animal, being all of the *Deer kind*, carrying the ſame ſort of Palmed Horns, which are of the ſame ſize and largeneſs as well as Figure; and the Bulk of their Bodies correſponding exactly in Proportion to the wide ſpreading of their *Horns*. So that we may ſecurely Aſſert, that *Mooſes* formerly were as frequent in this Country, as they have them ſtill in the Northern parts of the *Weſt-Indies, New England, Virginia, Maryland,* and *Canada* or *New France*.

And leaſt we may think this Animal peculiar to the *Continent*, and not to be found in Iſlands, A remarkable Paſſage in *John de Laet*'s *Deſcription* of the *Weſt Indies* clearly ſhews the contrary: *There are found,* ſays he, *great Numbers of theſe Animals in an Iſland near the* Continent, *call'd by* Engliſh Mount Manſell. This may give us reaſonable Grounds to believe, that as this Iſland of *Mount Manſell* muſt of neceſſity have had ſome Communication with the Main-Land of *America*, to have been thus plentifully ſtockt with this ſort of Beaſts; ſo *Ireland*, for the ſame Reaſon, muſt in the many paſt Ages, long before the late Diſcovery of that *New World*, have had ſome ſort of *Intercourſe* with it likewiſe, (though 'tis not eaſie, I acknowledge for us at preſent, to explain how) for otherwiſe I do not ſee, how we can conceive this Country ſhould be ſupply'd with this Creature, that for ought I can yet hear, is not to be found in all our Neighbourhood round about us; nay, perhaps in any other part of *Europe*, *Aſia*, or *Africa*: And then, 'tis certain, as *Ireland* is the laſt or moſt Weſtern Part of the *Old World*, ſo 'tis neareſt of any Country to the moſt Eaſtern Parts of the *New Canada*, *New England*, *Virginia*, *&c.* the great Tract of Land, and the only one I yet know, remarkable for Plenty of the *Mooſe Deer*.

XXXVII. *Tonna* inter *Thuringiæ* Dynaſtias haud poſtrema, *Erfurto* propinqua, Comitibus olim *Glichenſibus* paruit, iiſque Extinctis varios ſortita Do-

An Elephant *found under* Ground *near* Erfurt in Germany; By Wilh. Ern. Tentzelius n.234.p.757

minos Ducatui tandem *Saxo-Gothano* annexa eſt, ex quo ſereniſſimus Princeps, *Fredericus*, cujus Filium Cognominem feliciter hodie Regnantem ſuſpicimus, *A.* 1677. jure Emptionis Hæreditario ſibi ſuiſque eam comparavit. Binos habet Pagos ſeu villas ejuſdem Nominis, quorum alter appellatur *Burg Tonna*, quaſi *Caſtrum Tonnam*, alter *Grafen-Tonna*, quaſi *Comitis-Tonnam* diceres. Uter illorum Antiquior ſit, definire nequeo: Id ſaltem conſtat Annalibus vetuſtiſſimum Pagum eſſe, qui *Donnaba* audit in Diplomate *Ottonis Magni*, *A. Chr.* 973. dato, meaque Opinione ad *Burg Tonnam* ſpectat. Proxime Pago huic adjacet Mons ſive Collis *Arenoſus*, Arenam in fundo præbens puriſſimam albiſſimamque, in variorum Artificum uſum longe lateque tranſportari ſolitam: Quam effodientes Menſe *Decembri An.* 1695. Oſſa quædam Maxima reperiunt, ad Pedes Poſteriores ſpectantia, unum 19 Librarum pondere; deinde Globum ſive *Caput Rotundum* Acetabulo inſertum, Capite Viri majus, 9 Librarum; hinc Majus Os Femori ſimile 22. Librarum. Solito poſt Novi Anni initium Frigore amplius inquirentes, offendunt Spinam Dorſi cum Coſtis adhærentibus, profundiuſque in Arena abditos *Globos* longe majores binos, una cum Oſſibus eo pertinentibus, Pedum nempe Anteriorum; tum Os Humeri, 4 Pedes longum, Duaſque Spithamas latum cum dimidio: Mox Vertebras Colli cum vertice Acuminato; denique *Caput* prægrande cum 4. Dentibus Molaribus, quorum ſinguli 12. Libras pendebant, & Duobus maximis Dentibus ſive Cornubus, 2½ Spithamæ Craſſitie, & 8. Pedum Longitudine ex Capite prodeuntibus. Ut Caput melius conſpiceretur, Collis 12. fere Cubitorum, ſive 24 Pedum Altitudine perforatus eſt; quo facto ipſe ſereniſſimus Princeps 10. *Kal. Feb.* acceſſit, meque inter Comites eſſe clementiſſime juſſit, ubi omnes quidem in magno Hominum Concurſu Caput illum cum Dentibus prægrandibus admirabundi contemplati ſumus, maxime autem indoluimus, & Caput & Dentes, exceptis Maxillaribus, quos integros fere accepimus, & reliqua Oſſa, adeo Fragilia, conſumpta Carie, ſituque corrupta jacuiſſe, ut nullum eorum ex omni parte incontaminatum erui potuerit, ſed in plurimas Particulas disjecta fuerint.

Cum primum Fama emaneret, vulgarem ſimul Opinionem de *Oſſibus Gigantis* ea circumferebat, qua tamen nec mihi, nec aliis prudentioribus arriſit, & Viſo *Capite* ſtatim evanuit. Poſtea a vero Duæ Opiniones emerſerunt, quarum Altera, pro *Elephanti ſceleto*, Temporis diuturnitate maximam partem Petrefacto; Altera pro *Unicornu Foſſili*, ut vulgo vocant, ſeu Minerali jocantis Naturæ Fœtu, habuit. Prior ſententia mihi comprimis placet. Ex Collatione enim *ſceleti noſtri* cum Anatomia *Elephanti* quam Dublini in *Hybernia. A.* 1681. dedit *A. Moulinus* clariſſime liquet omnia huic noſtro convenire, quæ ad vera *Elephanti Oſſa* requiruntur. Ante omnia Notandum eſt, quod *Moulinus* refert in *Cranio Elephanti* extare magnum *Cellularum* Numerum, plerumque Triangularium, Membranulis obductarum, in quibus multa ſint *Vaſa ſanguinea* curioſe diſpoſita, iſtaſque *Cellulas* ex Tenuibus Bracteis Oſſeis factas eſſe. Enimvero *Cranium Tonnenſe* non tantum intus *Concavum* & inſtar Tumuli Formicarum perforatum fuiſſe referunt Foſſores, ſed e Fragmentis idem liquet manifeſtiſſime, quæ *Cellulas* iſtas, modo oblique, modo directe *Cranium* tranſeuntes,

ſeuntes, nobis ob Oculos ponunt, ex Tenuibus Bracteis conſtantes, & maximam partem Triangulares: Membranulas autem, *Vaſis ſanguineis* exſiccatis firmiſſime agglutinatas deprehendimus, Colore flavo ſubrubicundo tinctas, ſcalpro forte tentatas in fruſtula diſſilire, ſimulque Colorem iſtum auferre, ut Albedo *Cranii* emineat. Præterea quem *Moulinus* in *Cranio* obſervat Meatum *Medullæ ſpinalis*, & ſingularem Cavitatem pro *Cerebro capiendo*, in *noſtris* etiam Fragmentis apparet: & quam ille metitur Diſtantiam *Cranii* ab uno extremo ad alterum 20 ¼ *Digitorum*, in *noſtro* dicitur fuiſſe 3½ *Pedum* qui cum 42 *Digitos* faciunt, tum Conjecturam nobis præbent, *Elephantem Tonnenſem Hibernico* fuiſſe ad minimum duplo majorem; quod ex ſequentibus clarius patebit. De externa *Cranii Elephantini* forma alius *Anglus*, *Joannes Raius*, in *ſynopſi Animalium Quadrupedum* obſervat, *Poſticam* ejus partem in duos prægrandes *Sinus* ſeu *Lobos* ita dividi, ut *Clunes Humanos* referre videatur; neque, ut in aliis multis *Quadrupedibus*, *Cerebello* excipiendo Cavitatem, ſeu Alveum productum extrorſum conſpicuum habere, ſed potius *Cranii Humani* Figuram imitari. Obteſtor omnes, qui *Caput* in Arena jacens viderunt, annon hæc Definitio ipſi apertiſſime conveniat. Cæterum *Longiſſimi Dentes* illi ſive *Cornua*, præter Craſſitiem & Longitudinem indicatam, ſimul referebant Nativum *Lævorem*, *Colorem Subflavum* nigricantibus Maculis ſubinde conſperſum, *Curvaturam*, & *Strias* nullis aliorum Animalium *Dentibus Cornubuſque* communes: Imo quod maxime notari meretur, ſupereſt adhuc *Cuſpis* Dextri *Dentis*, apertiſſimo *Limationis* ſigno conſpicua, de qua *Plinius Arbore exacuere limareque Cornua Elephantos* memorat. *Lib.* 18. Neque prætererim, inter alios, qui ad viſendum *Tonnenſe* ſpectaculum undique adfluebant, veniſſe etiam Mercatorem, qui multos Annos in *India* conſumpſerat, & ſecundum Regulas *Indorum*, quas ſibi probe cognitas dicebat, ex *Dentibus* ſive *Cornubus* judicabat *Elephantem noſtrum* pluſquam 200 *Annos* vixiſſe. Quam in rem *Aldrovandus* allegat *Aloyſii Cadamuſti* Teſtimonium, vidiſſe ſe aliquando *Elephantem* occiſum perquam Mediocrem, cujus *Dentium* amplitudo *Palmos* (*i. e. Spithamas*) *Ternos* excedebat, eminebat ad *duos Palmos*, verum *Palmus* contectus Carne *Maxillæ* immergebatur, ut totus occultaretur, ut ſunt aliorum *Radices Dentium*; & quoniam eorum *Senecta Dentibus* cognoſcitur, aiebant Argumento *Dentium* fere deſpicabilis, ipſum haud quaquam *Annoſum* fore, ſi conferretur aliis Procerioribus, quorum *Dentes* tantæ ſunt Magnitudinis, ut vicem *Poſtium* ſuppleant, & pro *Palis* ſepes muniant, Teſte *Plinio*, & ut *Nigritæ* referebant, nonnullis eo Amplitudinis creſcunt *Dentes*, ut 12. *Palmorum* Menſuram excedant. Ultima Verba cum primis ad Propoſitum noſtrum faciunt: *Palmum* enim *Cadamuſtus* intelligit *Majorem*, quem *Spithamam* alioquin dicimus; 12. igitur *Palmi* 8 faciunt *Pedes*, quæ Longitudo eſt *Dentium Tonnenſium*. Non multum hinc abit *Dens Harduino*, Commentatori *Plinii* noviſſimo, *Dieppæ viſus ſeptenum* fere *Pedum*, *Centum* & amplius *Librarum pondere*; Præterea *Gillius* adſerit, eos ſæpe ad Longitudinem 10 *Pedum* augeſcere. Nec eſt quod Pondus *Centum* & amplius *Librarum* in *Dentibus Tonnenſibus* quenquam deterreat: Reperiuntur enim, quorum ſinguli pendent 140 *Libras*, qualem apud *Batavos* vidit Amicus; vel 150. ſive 200 *Romani Ponderis Duodecim unciarum*, *quales Eraſmus Franciſci memorat*, *vel*, 160. qualem in *Muſæo Septaliano* deſcribit *Terzagus*; quin *Ver-*

tomannus in *Sumatra* duos vidit, qui appenſi *Libras* 336 pendebant. Nobis interea ſufficere poteſt certum Miniſtri cujuſdam *Ducalis* Teſtimonium qui aliquot Annos in *Sumatra* aliiſque *Indiæ* Regionibus vixit, Teſtaturque *Dentes* ſibi viſos fuiſſe Longitudine *ſex* vel *Octo Pedum*, Craſſitie *Duarum & Dimidiæ Spithamarum*, Pondere *Centum* & 125. *Librarum*: Veterem Diſputationem, *Cornua Denteſve* ſint appellandi, non definio; neque tamen negaverim, placere mihi *Aldrovandi Bochartique* de Media illorum Natura Sententiam, quam Origo confirmat. *Pauſaniæ* pridem notata, quia Temporibus ſuperne deſcendere, & ita foras tendere, non Auritus, ſed Oculatus Teſtis ſcripſit, viſo in *Campaniæ Elephantis Cranio*: Eundemque Situm *Tonnenſes* præ ſe ferebant, quibus non obſtare poteſt *Moulini Raiique* Obſervatio, è *Maxilla Superiore* eos derivantium, internamque eorum Conſtitutionem ita nobis depingentium, quod *Intus* concavi *ſint, & quadam velut* Medulla, *verum compactiore, quæque* Glandularum *aliquam Mixturam habere videbatur, repleti*: addit *Raius*, ex Obſervatione *Lewenhoeckii, Eos ex conjunctis iiſque admodum Exilibus* Tubulis *conſtare, ex intima parte ſeu Cavitate* Dentis *Originem trahentibus, & ad Circumferentiam ejuſdem terminatis.* Cæterum hos *Tubulos* manifeſtiſſime in qualibet *Dentium Tonnenſium* parte conſpicimus, una cum *Corticibus* quaſi illis in rotundum extenſis, quibus *Elephantorum Dentes* ſingulis vel *Annis* vel majoribus *Vitæ* interſtitiis, diſtingui videmus; verum, ne quid Diſſimulem, Neuter *Noſtrorum* latiori pollet *Cavitate*, quam quouſque *Capiti* ſeu *Tempori*, vel potius *Maxillæ Superiori*, inſerti fuerunt; nec majorem *Cardanus Aldrovanduſque* in omnibus agnoſcunt, & quanquam ea a *Moulino, Raioque* latius extenditur, non alios tamen, quam *Juniorum Elephantum Dentes* producere poterunt, *Seniores* autem non alio modo comparatos puto, quam *Tonnenſes*, ejuſque differentiæ Cauſam in eo ſitam eſſe, quod in *Senioribus Tubuli* iſti Corticeſque non tantum ad extra augeantur, ſed etiam ad intra magis magiſque conſtipentur & coaleſcant, ac ſimul *Medulla* compactior *Glanduliſque* mixta ſenſim conglobetur & condenſetur.

Progredior ad *Dentes Molares*, quorum quatuor ſtupendæ Magnitudinis Ponderiſque in *Capite Tonnenſi* reperti fuerunt, iiſque exactiſſime convenit *Raii* Definitio, his Verbis concepta: Os *Bebnæ quatuor in utraque* Maxilla Dentium Molarium *Maſſis inſtructum. Siquidem plurimi* Dentes *in* Os *Solidum & Durum ita infixi ſunt, ut cum eo & inter ſe unum & continuum Corpus efficiant.* Dentes *hi Lineas Parallelas undulatas* octo *vel* novem *in Superficie Maſſæ efficiunt, ſuntque reliquo oſſe* Candidiores. *Maſſæ integræ* Dentium *ſingularium modo per* Gomphoſin Maxillis *inſeruntur*: *Anterior tamen in* Superiore Maxilla *extremitate altera in* Maxillam *infigitur, deinde* Palato Oris *Parallelos Antrorſum producta, in acutum tandem Mucronem deſinit, qui in Sinu ad id facto in extremitate* Maxillæ *excipitur.*

Inciſoribus *omnino caret.* Equidem his caret etiam *noſter Elephas Tonnenſis*, ſingulæ vero Maſſarium *Molarium* conſtant Oſſe Duro & Vitri inſtar candenti, nucleoque; tum in Superficie *duodecim* Lineas Parallelas *Undulatas*, ſive *Strias Molares* habent, reliquo Oſſe Candidiores, in quolibet latere *ſedecim ſtriæ* expreſſæ ſunt, totidemque Cavitatibus per *Gomphoſin Maxillis* inſerti fuerunt; quas ubi Scalpro perfoderis, repletas invenies Dura quadam ac Rubi-

cunda

teria, Medullæ Vaſorum Nervorumque Petrefactæ ſimillima: Præterea parte illa qua ex Maxilla prominuerunt, luculenter apparet Lævitas duorum fere Digitorum, qualem in Hibernicis notavit etiam Moulinus. Nec eſt, quod deterreri nos patiamur octonario Hibernicorum Numero, quanquam eundem in alio *Elephanto Peireſcium*, Brachio ſuo in Os Belluæ ingeſto, deprehendiſſe Gaſſendus narrat; pro Quaternario enim ſtant non tantum ex Antiquis *Ariſtoteles* & *Plinius*, ſed & ex Recentioribus *Walter Schultze*, qui diu in *India* verſatus eſt, ipſeque, ut videtur, *Raius* qui alioqui non *in utraque* ſed *ſingulis Maxillis* Quatuor Dentes dicere debuiſſet. Cauſam differentiæ quærere licet vel in Naturæ Varietate, quæ ut in aliis Animalibus, Homineque ipſo, ita etiam in *Elephantis* Numerum Dentium non ſemper eundem producat; vel in Ætatis differentia, ita ut Dentibus Poſterioribus in juventute exciſis Anteriores, copioſo adfluente Nutrimento, ſpatium expleant. Certe *Quatuor Tonnenſes* in Poſteriore ſui parte manifeſtiſſimas habent Extremitates proceſſuſque incurvatos, ex quibus liquet, in Maxillæ extremitate illos conſtitiſſe; eoſdem pars Anterior oſtendit, & qui Superiori Maxillæ inſerti fuerunt, non ſolum Longiores ſunt Inferioribus, ſecundum *Mulini* Obſervationem, ſed in Acutum quoque Mucronem deſinunt a *Raio* obſervatum; Imo omne fere Maxillæ explent ſpatium, quod *Octo* iſti apud Moulinum; metitur enim Longitudinem Anterioris Dentis in Maxilla inferiori ſex Digitis cum Dimidio Poſterioris tribus; Totius vero Maxillæ 21$\frac{1}{4}$. Digitis, uti Superioris Maxilla 18 Foſſores Tonnenſes Diſcrimen hoc non ſatis obſervantes eandem utriuſque Maxillæ Longitudinem dixerunt, Trium nempe Pedum, ſive Triginta ſex Digitorum; Dentes autem Maxillares ſibi invicem inſiſtentes repererunt, Longitudinem ſingulis Unius & Dimidiæ Spithamæ adſignantes, quam tamen accuratiori examine diverſam reperi; Superiorum quidem propter Acutum Mucronem Quindecim fere Digitorum, Inferiorum vero Quatuordecim. Accipimus autem Diſtantiam Maxillarum, quam iidem dederunt Foſſores, Trium & Dimidii Pedis, ſive 42 Digitorum: eaque cum diſtantia 21 Digitorum, quam inter Oſſa Lygomatica ſive Jugalia ſtatuit Moulinus, collata, denuo deprehendimus Magnitudinem *Elephantis Hibernici Tonnenſem* Bis æquaſſe; idem confirmat diſtantia *Cranii* ad uno Extremo ad alterum, in *Hibernico*, 20$\frac{1}{2}$ *Digitorum*, in *Tonnenſi* Trium & Dimidii Pedum.

Repertæ fuerunt etiam Vertebræ Colli, ſeu Cervicis (juxta Dimenſiones a Foſſoribus indicatas) Craſſitie Quatuor Spithamarum in Circumferentia, Duarum altitudine; quarum adhuc Tres optime ſibi reſpondentes ſuperſunt, earumque præcipua monſtrat Verticem Acuminatum. Repertum eſt Os Humeri cum Acetabulo & Capitibus ſive Globis duobus Maximis adhuc reſiduis, Pedumque Anteriorum Oſſibus, Ulnæ, Radii, Carpi & Metatarſi, quorum nonnulla tantæ fuerunt Cavitatis, ut manus tota inſeri potuerit; ſingula autem referta non Arenis, ſed minutiſſimis Medullæ Petrefactæ particulis, quæ Ori indita non Stridorem Dentium cauſantur, Arenæ inſtar, ſed in Lingua liqueſcunt, Guſtuque Terreo Tranſmutationem iſtam produnt. Repertæ ſunt Vertebræ Dorſi cum Coſtis adſtantibus, ſed nihil ex iis Integrum evaſit; Duo tantum Fragmenta Coſtarum exigua vidi, alterum Craſſitie Undecim, alterum plus quam 7. Digitorum. Repertum porro eſt Os Coxendicis 2$\frac{1}{2}$ Pedis

Longitudine cum Acetabulo & inſerto Femoris Capite; Moulinus Longitudinem illius non exprimit, ſed Oſſis Innominati, 25. Digitorum: at Os Coxendicis tertia tantum pars eſt Oſſis Innominati, reliquas duas, Os Ilion & Pubis, Foſſores dimetiri neglexerunt. Reperta ſunt Oſſa Crurum Pedumque Poſteriorum, Tibiæ, Fibulæ Tarſi, & Metatarſi: e quibus adhuc ſupererat pars Tibiæ, Principio & Fine carens, Craſſa tamen ſuperiori parte 22 Digitos, quibus ſurſum verſus ſex alios facile accreviſſe αὐτοψία docet; inferiori parte habet Craſſitiem 17 Digitorum, indeque rurſus Duplex emergit Craſſities, ac Longitudo Hibernici, cujus Tibiam dicit Moulinus Longam 19. Digitos; Rotundam, ubi Craſſiſſima, pluſquam 14. & ubi Tenuiſſima, 7½ Digitos. Hic notanda eſt major *Pedum Anteriorum* præ Poſterioribus Validitas & Craſſities *Elephantis* propria, & ab Alberto Aldrovandoque explicata. Neque enim tantæ Capacitatis eſt Tibia, ut Manum intrudi patiatur, quod in quibuſdam Oſſibus, Ulnæ ſine dubio, licuiſſe Foſſores aliique memorant. Denique ſuperſunt Bina ex Tarſi Oſſibus ſibi invicem contigua, ne quiſquam dubitet, illa etiam adfuiſſe. Omnia iſthæc Oſſa Poroſa & Rimoſa ſunt, ut in reliquis Animalibus, alteriuſque Planæ Formæ, ac Dentes, tam Maxillares, quam Exerti.

Situm quoque Totius Animalis attendere juvat. Cornua ſive Dentes Maximos verſus Ortum ac ſeptentrionem protendebat; *Pes Anterior ſiniſter* Lateri Capitis adjacebat extenſus; dexter ſub Corpore deorſum inclinatus; ſiniſter Poſterior in Acetabulo incurvatus, *Dexter* denique initio ſtatim repertus & hinc inde diſtractus fuit. Quæ omnia ſitum minime naturalem vel Ordinarium, ſed Extraordinarium plane violentumque produnt. Tandem Foſſores referunt, Oſſa quidem illa jacuiſſe debita ſeries, ſed ubi ſunt Inarticulationes, partim Palmi, partim Semipalmi [Palmum Minorem Quatuor digitorum intelligo] ſpatio diſtincta fuiſſe. Quorum Rationi Pinguedine, Cartilaginibus ac Ligamentis, Carne denique ac Inteſtinis ſita eſt, quibus Putrefactis vacuum Locum Arena occupavit, Artuſque Pondere ſuo magis magiſque disjunxit.

Nunc ad aliam Diſquiſitionem venio. An illa ſint Unicornuum Foſſile ſive Minerale in Terræ Gremio Generatum, vel potius Animal Putrefactum? Equidem nemo Rerum *Phyſicarum* non prorſus Imperitus inficias iverit, dari ejuſmodi Foſſilia ſeu Mineralia, Calvariarum Prægrandium, Dentium Oſtiumque ſpecie efficta: Et quomodo Natura tam Immanes *Calvarias*, tam Immania *Humani* (adde & *Animalis*) Corporis Membra, ad *Femorum*, *Tibiarum*, *Coſtarum*, *Dentium*, ſimilitudinem producat, omnium optime clariſſimeque explicatum dedit *Kircherus* dicens, *Latere in ſubterreſtribus viſceribus intra ſaxoſorum Montium Iliatus, Terram quandam Limoſam, quam* Margam *cum* Agricola *ſupra nominavimus*, Gypſeæ *Materia miſtam; quæ Terra ubi per Rimas Montium* Nitroſum Fluorem *receperit, fit, ut illa veluti Cortici quodam* Gypſeo *induatur, qui uti cum Tempore Lapideſcit, ita quoque* ſalis Nitri *ſplendore Albedine ſua* Os *proxime æmulatur, utpote Candidum, Rimoſum, & Friatile. Si itaque intra Terræ Concavitatis Rotundæ locum invenerit, naſcetur Pila Rotunda, quæ diſcuſſa* Calvariam *proxime æmulatur; ſi Matrix fuerit diſpoſita ſub Forma* Femoris Humani *(alteriuſve Animalis) aut* Coſtæ *aut alterius Membri*, Marga *in ea contenta ſuper affuſo*

Mund ſubter lib, 8. c. 4.

Sal Nitroſo Liquore, Femur Humanum *Minus*, *Majus*, *Maximum*, *& prorſus*, Giganteum; *pro Matricis Magnitudine exprimet*. *Atque hæc ſunt Oſſa iſta, quæ Natura producit, & paſſim Oſſa* Gigantum *communi Hominum perſuaſione dicuntur; quæ tamen ſi confregeris, nulla in eis nec* Medulla, *nec* Medullæ Fiſtuloſus Meatus *reperitur, quod fieri deberet, ſi* (Hominum *Animaliumque*) *Oſſa forent*. Has Obſervationes ſuas certiſſima Experientia *Kircherus* ipſe confirmat, Viſis abs ſe in Pariete Antri Panormitani Dentibus Parvis, Mediocribus, Maximis & Exceſſivæ Magnitudinis, ea ſerie, qua Natura Maxillis Animalium inſerere ſolet, infixos, tanta Copia, ut centum Carros inde onerari poſſe facile crediderit: alibi protuberabant Vertebrarum, Genuum, Tibiarum & Calvariæ Veſtigia, nullo tamen Ordinis nexu, nec quidquam inter omnia Oſſeæ ſubſtantiæ veſtigia, Organizatum uti ſunt Caput, Manus, Pedeſque reperiebatur; Unde luculenter admirabilem Naturæ in Oſſibus, aut Oſſibus ſimilibus *Saxis* formandis Induſtriam primo ſe cognoviſſe fatetur Kircherus, in Marchione Ventimiglia, Luſtrationis Comite, duo edoctus, nobis maxime proficua; quorum Alterum eſt, In Agro Solonio juxta Mare, *Drepanum* & *Panormum* inter, ab Agricolis vera adhuc erui *Oſſa Elephantum*, qui præteritorum ſeculorum Temporibus ab *Afris*, in *Siciliam* contra Hoſtes in Bellum educti, ibidem interfecti Tumulati ſunt, poſſens Temporibus tandem detectis *Oſſibus*, quæ & imperiti paſſim pro *Gigantium Oſſibus* venditant: Alterum, hoc diſcrimen eſſe inter Oſſa vera & a Natura Minerali producta, quod Illa ſemper *Tibiarum Canales*, *Fiſtuloſoſque Meatus* olim *Medulla* refertos retineant. Hæc vero ſolidum Lapidem ſine ulla *Tibiarum Concavitate* mentiantur. Tonnenſia verum, tantum abeſt ut *Meatibus Medullaribus* careant, aut, ne reliquas Kircheri Regulas omittamus, nullo *Ordinis Nexu* inter ſe jaceant, nihilque *Oſſium Organizatorum* contineant, ut potius ea omnia ibi Luculentiſſime extent omniumque Oculos incurrant.

Quæcumque enim in *Elephanto* ſunt Oſſa Convava & Fiſtuloſa, Medulliſque Referta, ea in noſtro etiam Sceleto paria faciunt: Nec Turbare nos debet *Exertorum Dentium* Soliditas ad eam uſque partem, qua in *Maxilla* figuntur, quippe in Maximis Nativis etiam deprehenſa. Omnia porro iſto *Ordine* inter ſe connexa ſunt, quem Natura requirit, ſitu Violento & Extraordinario non Impedita, *Oſſa* quæ *Kircherus Organizata* vocat, & inter *Mineralia Antri Panormitani Oſſa* fruſtra quæſivit, noſtro Sceleto, ne Minimo quidem Excepto, quod ex Reliquiis colligitur, Perfectiſſime comparuerunt.

Cranium ſane *Cellulis* pro *Vaſis Nerviſque* Tranſmittendis curioſiſſime diſtinctum eſt, nec *Cavitate Cerebri*, *Medullave Spinalis Proceſſu* diſtituitur: *Dentes Exerti* nativum *Colorem*, *Lævorem*, *Strias*, *Tubulos*, *Interſtitia* ſive *Cortices*, referunt, imo Dexter ab Animali Vivo Limatum ſe prodit: *Maxillaris* Deſcriptioni Raianæ optime convenientes ſua gaudent *Gomphoſi*; ſeu Cavitatibus Sinuibuſque, quibus *Maxilla* inſerti fuerunt, *Medulla Rubicunda* Petrefacta adhuc repletis; Vertebræ Colli Acuminato Vertice præditæ, & Oſſa Tarſi, ſibi invicem reſpondent: Capita Maxima ſeu Globi Acetabulis ſuis, *Coſtæ Spinis Dorſi*, junctæ fuerunt. Nec plura ex præcedentibus repeto, cum hæc altius expenſa cuilibet perſuadeant, non poſſe *Naturam Ludentem* ſibique relictam, nec Animali cujus Partes ſunt concurrentes, Corpus ejuſmodi *Organicum* omnibus Numeris abſolutum formare: aut ſi quis regere ſoluerit, dari nonnulla Unicornua Foſſilia vulgo dicta, & Mineralia, quæ Fiſtuloſos Meatus habent, illi ex *Kircheri* Principio, in ipſa Experientia Fundato, facile reponerem, Foſſilia iſthæc non ex *Mineralium*, ſed *Animalium Genere* eſſe, contrariam Sententiam probandi Onus eidem relinquens. Invictum enim Argumentum eſt, quod in Conjecturis de Antiquiſſimo Statu *Helmſtadii* p. 13. proponit *Conringius: Poſſe vero* Naturam, *Relictum Sine Omnibus Adminiculis, Oſſa undequaque Perfecta condere qualia in* Fœtu *primum conformantur, deinde in* Adultis *diuturna Nutritione Animali perfici ſolent, id vero eſt ἐν τῶν ἀδυνάτων. Eoque Solius* Naturæ Luxuriantis Luſui *tribuere, confectionem tot in Uſus Vitæ conformatorum & omnibus modis abſolutorum* Oſſium *utique ſine Nota* Summæ Abſurditatis *haud licuerit.*

Accedit alterum Argumentum non Minoris Ponderis, quod eodem loco *Kircherus* nobis ſuppeditat, dicens *Margam* pro diverſa Cavitatis, ſeu Matricis in Terræ Viſceribus Diſpoſitione, diverſa Oſſium Simulacra producere. Licet itaque in Arenis Tonnenſibus Margam Succumque ſeu Aquam Lapideſcentem, quæ *Kirchero Fluor Nitroſus* audit, recondi facile conceſſerim, tamen quis unquam ſibi imaginabitur, Cavitatem ſeu Matricem ita ibi olim diſpoſitam, ut *Sceleton Elephanti* Situ Extraordinario ſupra Deſcripto injectum repræſentarit, quam poſtea Marga Fluens fortuito deprehenſam repleverit, Temporiſque Succeſſu in iſtam excreverit Molem? Certe influit eadem eadem natura, eadem Materia, idem Calor, idem Humor, idem Fomentum Terræ, eadem Generandi Ratio, ſed Diverſiſſima Producta ſunt pro diverſitate *Oſſium Elephanti* Genuina; quatenus ſunt in *Capite* Cellulis Diſtincta; in *Dentibus Maxillaribus* Vitri inſtar Dura & Candentia Striis undulatis prædita; in *Cornubus* ſive *Dentibus Prominentibus* Lævia, Flaveſcentia, in Cuſpide *Limata*, Striata, Tubulis ac interſtitiis conſpicua; in reliquis Oſſibus Poroſa: & planæ ad Normam Rationemque Corporis Organici formata? Quis, inquam, rebus ſic ſtantibus, illam in Sententiam ſe unquam abduci patietur? Nonne multo eſt veriſimilior Altera *Anſelmi Boetii de Boodt, Rudolphi II.*

Imperatoris Archiatri, in *Hiſtoria Gemmarum & Lapidum Lib.* 2. *Cap.* 242. qui poſtquam docuerat, Margam *Lapideſcente & Subterranea Aqua fluente irrigatam vel ſolutam. Lactis inſtar Fluere per Terræ Cavitates, abſorptaque Seroſiore Aquæ parte, craſſiorem Cavitates implendo ſiſti, & abſumpto Humore omni coaleſcere, Lapidiſque Formam &* Cornuum *præ ſe ferre*; quæ *Kircheri* aliorumque communis eſt Opinio: Subjicit; *Verum ſi Lacteus hic Humor non in Cavitatem, ſed in* Lignum *aliquod vetuſtate arefactum incidat, illiuſque Corpus jam Leve & Poroſum ſubeat, tandemque vel exhalata Aqua Tenuioris portione Craſſior remaneat, tandem coagulata* Lignum *tranſmutat ejuſque partes ſibi aſſimilat, ita tamen, ut Species* Ligni *noſci & interdum Odor, deprehendi poſſit. Quod* Ligno *contingit id etiam* Cornubus Cervinis Dentique Elephantis *aliiſque Quadrupedum partibus, ſi in hujuſmodi loca decidant, contingere poteſt. Hinc fit,* Cornua *iſta* Foſſilia *inter ſe multum Differre, & Pauca eandem Faciem oſtendere, imo aliqua* Dentes, Tibias, Maxillas, *aliaſve Corporis Partes referre.* Hanc Sententiam proxime ad Veritatem accedere judicat *Olaus Wormius* in *Muſæo pag.* 54. Quid igitur vetat, Epicriſi horum Doctiſſimorum Medicorum acquieſcere, modumque, quo in *Petram* converſa ſunt *Oſſa Elephanti Tonnenſis*, verbis eorum exprimere, præſertim cum non ſolum *Dentes Elephantis*, ſed alias quoque partes quadrupedum, (quidni & omnium maximi?) hac ratione mutari poſſe diſſertiſſime fateantur.

Devenerat igitur quovis modo ac tempore (de quo infra diſpiciemus) in Collem arenoſum *Tonnenſem Elephas*, cujus *Oſſa* temporis longitudine areſacta calcinavit ignis ſubterraneus, eaque jam Levia & Poroſa ſubiit *Lacteus* ille *Margæ* Humor, & exhalata Aquæ tenuioris portione craſſior remanſit, (cujus particulas in *Oſſibus* poroſis ob majorem Albedinem ab eorum Subſtantia facillime diſcernere licet,) & tandem coagulata totum *Elephanti Sceleton* tranſmutavit, ejuſque partes ſibi aſſimulavit, ita tamen ut *Species Oſſium* interna & externa noſci, & forte etiam *Odor* deprehendi poſſit. Ultimum de *Odore* ſubdubitans adjeci, quoniam tentare nondum licuit. Si tamen *Boetius odorem* intelligit, quem *Ligna & Oſſa petrefacta* in *Furno Chymico* ſpargunt, id de noviſſimo Examine adſeverare poſſum, quod Nares propius admoventium idem prorſus adflaverit Odor, quem Oſſa, Cornuaque aduſta dare ſolent. Aliquot *Eboris* ſive *Dentium Elephanti Foſſilium* Exempla protulit *Bartholinus* poſtremo de *Unicornu* Capite, in medio quidem relinquens, num *Dentes* fuerint in *Lapideam* duritiem compacti Ætatis Moræque Ambitu, an ex prima Lapidum Mole incertam tantum Dentis Cornuve Figuram effecti a Natura; Faſſus tamen, utrique ſuam eſſe rationem, ſi alterutrum nolis; neque ſpernenda Petrefactionis Exempla Cauſaſque adjiciens. Ad eundem modum hæſitabundus pronunciat de Dente Maxillari Elephantis, alteroque Roſmari in Petram ſeu Silicem converſis; Noſtram tamen Sententiam diſerte amplectitur alioque Roſmari Dente illuſtrat Medicus Iſlandus *Arngrimus.* Eidem apertius favet *Antonius de Pozzis*, Archiater *Cæſareus*, in Epiſtola ad *Lambecium*, quam ipſe *Lambecius* una cum Figura Dentis Elephantini Maxillaris Tomo VI. Commentariorum de Bibliotheca *Cæſarea* appendit. *p.* 315, 316. Is enim non ſolum Dentem iſtum, ſed & *Femoris Tibiarumque Oſſa Badena* reperta, pro veris Elephanti, ſed Petrefactis, habet; Addito Ratiocinio, quod ſi lapideam mentiatur Naturam, hoc accidit a Terra, cui ſepeliuntur, occultis Conatibus, quæ ſuo Concentrato Archeo Semina extrahit Lapidificationis atque indurat. Plura ejuſmodi Elephantina Petrefacta in Romanis Cimeliis ex Celeberrimi Ciampini, Obſervatione colligo, quam in *Ephemeridibus Naturæ Curioſorum*, *An.* 1688. *p.* 446. deprehendi.

Act. Med. Haf. Tom. I. pag. 83, 84

Ib. Tom. 4. p. 182.

Refert enim *Oſſa* quædam Miræ Magnitudinis effoſſa, *Femoris*, *Scapulæ*, & *Vertebrarum* quinque, inter quas erat illa Cervicis, quæ pondere ſimul 180 Libras Romanas excedebant; & a pleriſque pro Giganteis habita, cumque aliis ejuſmodi in Urbis *Cimeliis*, *Chiſiano* præſertim, collata, omnium maxima erant. Dubio autem exorto, an revera Gigantis, aut potius Elephantis eſſent, ad Eruditum Amicum *Florentiæ* commorantem datæ fuerunt Literæ, ut Exemplar Sceleti Elephantis, qui in Celebri Medicorum Muſæo viſitur, mittere non dedignaretur, qui Petitioni benigne annuens, optatum tranſmiſit Exemplar, quare facta cum Oſſibus Collatione Unanimi Conſenſu judicatum fuit, tam illa noviter reperta, quam in Cimeliis aſſervata Elephantum eſſe, & pro certo habuimus, illorum Elephantum fuiſſe, quorum

Plinius

Lib. 8. Cap. 8. & 6. *Plinius* meminit ; Addit *Ciampinus*, varia deinde alia Oſſa Lapidefacta, Denteſque Foſſiles collata fuiſſe.

Non diffiteor, optime *Magliabechi*, cùm mihi de *Oſſibus Tonnenſibus* cogitanti hæc in Mentem redirent, primum inde ortum Conſilium, rem totam tibi exponendi, quod ſpe teneret haud infirma, Litis Romanæ Sceleto Mediceo feliciter ſopitæ Exemplo, noſtram quoque terminari poſſe. Ratum interim firmumque eſto Sceleton Elephanti Tonnenſis priſtinam Oſſium Naturam Calcinatione ſubterranea, Philoſophicæ Analoga, maximam partem perdidiſſe, adeoque Oſſium Calcinatorum inſtar friabile eſſe, ac inſigni aſtringendi Robore pollere. Equidem ſi Ebori nativo aſtringens vis eſt, quæ tamen Guſtu non percipitur, ut *Aldrovandus* adnotavit, quidni ea potius ſe exerat linguæq; adhereat in ebore, tot annis in terræ gremio latente, calcinato & maximam partem petrefacto ? Neque enim Oſſa noſtra in Lapidem ita converſa ſunt, ut nulla Oſſa Naturæ intrinſeca remanſerint Indicia, quæ Examine Chimico per Ignem inſtituto extorqueri poſſunt. Id ſane cum apud nos ſuſciperetur, non ſolum in Vaſe Fictili, quod retortam vocant, remanſerunt fruſtula Oſſium injecta, & Colorem Figuramque Spodii, & Odorem Oſſis Cornuque aduſti manifeſte referentia ; ſed etiam Plegma vitreo Vaſe, cui Recipientis Nomen, exceptum, *Sal Volatile* Guſtu, & *Oleum* pinguedine tenui innatante prodiderunt. Poſtea Particulæ iſtæ Oſſium in Figuli Fornace fortius Calcinatæ, Albo Colore præditæ, Tubulos Striaſque Dentium Elephanti aperte monſtrabant : tam Elutriatæ & inſpiſſatæ, ut Chymicorum Vocabulis utar, tam in Sedimento, ſeu Lixivio, *Sal Chryſtallinum* continebant, quam in Phlegmate Saporem multo Acriorem Linguæ guſtandum præbebant, Oculis jucundo Spicularum Salinarum innatantium Spectaculo relicto. Quæ omnia quidem ex Oſſibus Cornubus, quæ Animalium quotidie eliciuntur, nulla tamen hujus generis ex Lapidibus, Margis aut Oſteo Collis erui poſſunt cum Lapides ne calcinnari quidem ſeſe patiantur, ſed in Calcem Igne degenerent ; cujus Rationem *Kircherus* in Exigua Humiditate quærit, qua fit ut Partes ſpirituoſæ Lapidum ob Sulphuris Pinguidinem partes fixas in Calcem reſolvant. Quis igitur amplius dubitaveit meæ ſubſcribere Sententiæ, faterique, vera Elephanti Oſſa Tonnæ reperta, ſed Igne ſubterraneo, quem ſatis prodit Odor Sulphuris Terreſtris in Phlegmate Reſiduiſque Particulis, Calcinata, & maximam partem petrefacta ? quæ Cauſa eſt, quod nec *Sal Volatile* nec *Oleum* ea Quantitate ſperare inde liceat, quam Oſſa Recentia ſuppeditant ; idque magis, cum in his etiam, ex Medici *Angli Cloptoni Havers*, in noviſſima *Oſteologia*, Obſervationibus, *Sal Volatile* vix Trigeſimam, Oleum non multum ultra vigeſimam quartam, Oſſium partem conſtituant ; tantillum vero in Oſſibus Lapidefactis fere abſorptum, ejuſque vix ſuper eſſe veſtigia, quis iverit inficias ?

Mund. ſubt. Lib. x. Cap. 4.

Cæterum alius nonnullis eximendus reſtat Scrupulus, qui negant, ullum in Rerum Natura Elephantem unquam fuiſſe, cui tantæ Magnitudinis *Oſſa* conveniant. Enimvero hos ego jubeo ſecuros eſſe, & *Indiæ Africæque* Itineraria adire: in quibus non ſolum Tantæ, ſed Majoris etiam Proceritatis Elephantos reperient. *Hybernicus* quidem *Moulini*, ad cujus Normam

Noſtrum ſæpius exigimus, vix major fuerit *Antwerpienſi*, quem *Goropius Becanus* apud *Aldrovandum* accurate dimenſus eſt, ejuſque Altitudinem octo Pedum reperit. In *Sceleto* autem *Hybernico* Longitudo Oſſis innominati eſt 25. Femoris 28. & Tibiæ 19 Digitorum, qui ſimul efficiunt 72. Digitos, ſive Sex Pedes; his duos addo Pedes pro explendo ſpatio, quod *Planta Pedum*, *Curvatura Dorſi*, *Cartilagines*, *Cara* denique & *Cutis* requirunt; indeque colligo, quam dixi, *Hybernici Elephanti Octopedalem* Altitudinem. Cum vero Collatio ſupra inſtituta docuerit, *Tornenſis Oſſa* ad minimum altero tanto majora fuiſſe, inde ſimul conficitur, *Sedecim* circiter *Pedum* Altitudine illum eminuiſſe. Hæc autem tantum abeſt, ut inſolita ſit, ut potius *Julius Cæſar Scaliger* Exercitatione 204. eandem diſerte notaverit, ex *Indicarum* Navigationum Scriptoribus referens, *Elephantos Senum Denum Pedum* excedere Proceritatem. Sed dantur longe majores *Joannes Jacobus Saar*, in Itinerario refert, certum Menſuræ Genus, *Gobdel* appellatum, tres partes Ulnæ (*Norinbergenſis*, ut Arbitror, propter Auctoris Patriam) æquans, & Trecentorum ſive Quadringentorum *Imperialium* Prætio æſtimatum, cui vendibiles Inſulæ *Ceylon Elephantes* ſubjiciunt, Altitudine 7. 8. 9. 10. & undecim *Gobdel*, neque Majores ſibi viſos eſſe. *Ulna* autem *Norinbergenſis* 4 circiter Digitis ſuperat duos illorum Pedum quos hactenus adhibui; unde ſequitur Menſuram *Gobdel* circiter eſſe 21. digitorum, adeoque maximum *Elephantorum Saario* viſum pluſquam 19. Pedum Altitudinem habuiſſe. *Philippus Pigafetto* in Deſcriptione Regni *Congenſis*, *Africani* Fidem facit, Veſtigia maximorum ibi *Elephantorum* in *Diametro* 4 *Spithamas*, quæ duos Pedes & 8 Digitos referunt, excedere; in *Elephanti Antuerpienſi* Calcis ſive Plantæ Imæ Diameter Pedis unius & duorum, paulo plus minus, Digitorum erat. Collato utroque Diametro deprehendemus, maximorum in *Africa Elephantum* Altitudinem 18 Pedes ſuperare. Sed inde ſimul liquet, Hodienum *Elephantos Judicos Africanis* majores eſſe, quod *Aldrovandus* & *Bochartus* ex antiquis probant Scriptoribus. Nec dubito, quin ex *India* fuerit allata *Coſta Elephanti*, quæ *Anatomico* Academiæ *Leidenſis* Theatro oſtenditur, juxta exteriorem flexuram 8 admodum Pedes longa, & ubi ſpiſſiſſima eſt, circa *Oſſis Sterni* commiſſuram, *Pedem unum* cum *tribus Unciis* circuitu ſuo implens, a *Theodoro Rickio* in Oratione de *Gigantibus* deſcripta; ut longiſſima *Elephanti Hybernici Coſta vix* 32. *Digitorum* erat; cumque 8 Pedes 96 Digitos contineant, ſequitur *Elephantum* iſtum cujus *Coſta Lugduni Batavorum* ſervatur, 24 *Pedes* Altitudine æquaſſe; ac tales profecto ad minimum fuerint *Elephanti Coſrois*, *Perſarum* Regis, ab Anonymo *Arabe* apud *Bochartum* celebrati. Nonnulli duodecim Cubitos proceri erant, *quod valde rarum eſt*; *quia plerique non ſuperant* 7 *Cubitos*. Si *Cubitus* in ſenſu vulgari apud nos accipitur, vix *duos Pedes*, *i. e.* 24. Digitos æquat, eoque pacto hi *Elephanti* ejuſdem cum *Leidenſi* fuiſſent Proceritatis; Sed mihi videtur *Coſroes Elephantos* ſuos Dimenſus antiquis *Perſarum Cubitis*, a *Golio* in Notis ad *Alferganum* p. 74, 75. ex Scriptore *Arabi Geodatico* explicatis, quorum ſinguli *Digitos* 27 comprehendebant. Hoc autem modo quilibet iſtorum *Elephantum* fuiſſet Altitudine 27 Pedum. O ſtupendam vereque rariſſimam & Regio ſtabulo dignam illorum proceritatem! Quam quicunque conſideravit *Tonnenſem* noſtrum, pluſquam Dimidia parte minorem, non adeo mirabitur.

Verum unde tandem in has Terras, Collemque hunc Arenarium pervenit *Elephas* hic, ſolito ſaltem major? Hæc ſane Quæſtio, *eruditiſſime Magliabechi*, plurimas curioſorum conjecturas peperit, quorum alii a *Romanis* Mercatoribus, alii ab *Attila*, alii a *Carolo magno*, alii a *Comitibus Glichenſibus*, alii ſuperiori demum Sæculo, in hanc Regionem delatum Tumulatumque finxerunt. At præterquam, quod earum ſingulæ ſuis laborant Difficultatibus, quas nunc enarrare ſuperſedeo, omnes certe variis Argumentis ſimul infringi poſſunt. Cujuſmodi eſt, quod *Eboris* uſus antiquiſſimos credere non permittit, Defoſſo ibi Elephanto Dentes præſtantiſſimos, ac longiſſimos, haud fuiſſe ademptos; nec tantæ Proceritatis Bellua ex *India* vel *Africa* facile tranſferri antiquioribus temporibus, aut recentioribus circumduci potuit; & ab aliis obſervatum eſt, non Seniores Ætate, ſed Juniores, in *Europam* deportari; multo minus quiſquam in mortui *Elephantis* Gratiam tantæ profunditatis, 24 Pedum, foveam fieri curaverit. Maxime autem illis adverſatur ipſa Montis arenoſi Ratio, quæ diligentius inſpecta nunquam ſe perfoſſam, & deinceps rurſus repletam, manifeſtiſſime prodit. Primum ſtratum ſuppeditat Humus Atra 4 Pedum; ſuccedit Glarea friabilis duorum & dimidii Pedis, cujus Medium *Oſteocolla Tofaceique Lapides duorum Pedum* Altitudine explent, ut & ſub ea dimidii Pedis ſpatium; ſequitur *Argilla* arenoſa 6 circiter Pedum, in qua iterum *Oſteocolla* duorum Digitorum, & infra unius Pedis Altitudine occurrit; hanc excipit alterum Glareæ ſtratum 6 circiter Pedum; eique demum ſubjacet Arena alba & pura, cujus Profunditas nondum explorata eſt, quod in ea, vix tres Pedes effoſſa, *Elephanti Sceleton* apparuit. Enimvero ſi unquam perfoſſus injectoque *Elephante* repletus iterum fuiſſet hic Collis, minime ſtrata ſtratis ordine impoſita; ſed omnia illa Arenarum genera Terræ nigræ permixta inveniremus; ut quotidie in *Tumulis* fodiendis fieri ſolet. Multo minus *Tofacei Lapides*, in hanc duritiem coaleſcere, aut Oſteocollæ Radices ſuas venaſque, per totum Montem ad ipſum uſque ſuperficiem conſpicuas, ſpargere, tantave Quantitate creſcere, potuiſſent, ut ſtatim in medio primæ Glareæ, quæ Atram Humum proxime contingit, duos Pedes, & ſub ea *Dimidium* explerent ſeque inferius in *Argillam* arenoſam extenderent, ſpatium duorum Digitorum & ſub ea Pedis unius occupantes. Nihil igitur ſupereſt, præterquam Univerſale Diluvium, in quo periit cum aliis ſui generis diverſique Animantibus, *Elephas noſter*, undique immanibus raptus & jactatus, Aquis tandem decreſcere incipientibus, fundum petiit; cui Aquæ iſta diverſarum Arenarum Strata induxerunt; iiſque in Superficie exſiccatis, *Atra* tandem *Humus* ſenſim accrevit. Quemadmodum enim *Diverſa Arenarum Strata* ſatis probant, Collem Tonnenſem ex Diluvio Originem trahere; ita Altitudo Terræ Nigræ idem confirmat. Utrumque breviter oſtendendum mihi video.

Prius faciam præclaris Obſervationibus, a *Nicolao Stenone*, Medico apud vos quoque celebri, in Diſſertatione de Capite *Canis Carchariæ* Diſſecto, quam *Myologia* Specimini adjecit, ſuppeditatis, quas tamen omnes deſcribere vetat Epiſtolæ Ratio. Loquitur quidem ille præcipue de *Aquatilium Animan-*

tium *Partibus*, uti ſunt *Oſtreorum Teſta* & ſimilia, cum ex Terris eruuntur: Sed nihil prohibet de *Terreſtrium* quoque Animantium *partibus* eo modo *effoſſis* idem pronunciare. Etenim Colli *Tonnenſi* applicari plane poſſunt, quæ *Steno* refert de Terra, unde Corpora hæc eruuntur. Nam & iſte quibuſdam in locis durior eſt, *Tophumque* & *Oſteocollam* continet, in aliis mollior, *Argillæ* Sabuloque refertus, compoſitus ex *ſtratis* ſibi mutuo impoſitis, & ad Horizontem obliquis. Bene autem arguit *Steno*; *Terram Mollem ſpectat, cum eo molliora ſint Corpora illa*, (nos *Elephantis noſtri Oſſa ſubaudiamus*) *minuſque contactum ferant, quo profundius latent; tantum abeſt, producat ea Terra, ut potius eadem deſtruat: Nec eſt, quod quis credat, ideo molliora ea eſſe quia nec dum perfecta ſunt; quæ enim mollia ſunt, dum generantur, quodam quaſi Glutine unitas inter ſe partes continent, (ut videre eſt in Recentibus Pinearum & Amygdalorum Corticibus:) at hæc corpora omni Glutine privata in Pulverem dilabuntur, adeoque Mollities ea deſtructionis, non Productionis, Argumentum videtur.* Quæ in ſequentibus diſputat *Steno*, Terram iſtam non fuiſſe compactam, cum prædicta Corpora ibi producta ſunt; eamque Aquis olim non ſolum tectam, ſed plane immiſtam, imo pro Aquæ ſedimento ſenſim congeſto, habendum eſſe nullo Negotio ad Collem *Tonnenſem* referri poſſunt: Mihi tantum excerpere quædam placet, ex *p.* 211, 212. *Quod* Argilla *&* Sabulum Aquæ *vehementius agitatæ immiſceantur, præceps Torrentium per id Generis Terras prolapſus, & Aquarum a ventis agitatio, notius reddidere quam quod pluribus exponi mereatur. Nec probatu difficile eſt, in Aquis ſtagnantibus, imo in limpidiſſimis Aquis*, Sabulum, Argillam, *&* Tophos *omniſque Generis Solida ſæpius deliteſcere*. Quis ergo amplius dubitaverit, Collem *Tonnæ* Arenarium ex *Diluvii Sedimento* ſupereſſe? Plura hanc in rem ex Terræ Viſceribus petita Argumenta ſuppeditat *Jacobus Grandius*, Medicus *Venetus*, in Epiſtola de Veritate *Diluvii Univerſalis*, *& Teſtaceorum*, quæ procul a Mari reperiuntur, Generatione e quibus tantum tria priora excerpere juvat. I. *In multis Montibus altiſſimis non ſolum* Europæ & Aſiæ, *ſed etiam* Africæ *&* Americæ, *extant certa Veſtigia* Maris, *quod illic Sedimenta deponens Strata produxit Uniformia, & Horizonti Parallela, quod nulla Ratio ſuadet contingere potuiſſe, niſi tempore Diluvii univerſalis.* II. *Idem teſtant urlongiſſimi Terrarum Tractus, obducti variis Collibus Arenoſis, ex Alluentis & Turbidi Fluidi Sedimento ortis, & magnam cum* Maris *Fundo ſimilitudinem habentes.* III. *Magnæ Apertura Montium, Fluminum, atque Torrenſium Corroſione facta, oſtendunt diverſa ſolida ex affuſo & ſupernatante Fluido, diverſis modis diverſa corpora comprehendente atque lapideſcente, producta; Itemque varia Sedimenta ſibi invicem impoſita, Veris* Conchis, *& aliis marinis abundantia.*

Cæterum, de *Atra Humo* poſt Diluvium *Terræ* adnaſcente, multa Peculiaria obſervavit *Olaus Rudbeckius*. Medicus *Suecus*, Tom. I. *Atlanticæ*. Cap. VI. quæ aliis quoque doctiſſimis probata Viris nunc tranſcribere nihil attinent: ad noſtrum tamen *Collem Arenarium* ſi applicare placuerit, ſciendum prius eſt, in illis quidem Sylvæ *Thuringicæ* Montibus, qui Metalla continent, & ex duriſſimo conſtant ſaxo, *Atram* iſtam *Humum* duorum circiter Pedum deprehendi, multoque tenuiorem pro montium Declivitate: Aliis vero in Locis quatuor Pedes æquare vel excedere, cum primum in Vallibus, quæ illam Pluvia ex Montibus ad ſe derivatam exceperunt. Quod uti facit ad *Rudbeckii* deſiderium Altitudinem *Nigræ Terræ*, in Regionibus *Sueciæ* Calidioribus, & Pluvia copioſiora irrigatis noſſe cupientis; ita viciſſim oſtendit, Altitudinem ejus quatuor *Pedum* in Colle *Tonnenſi* a Diluvii Tempore haud fruſtra derivari, indeque evinci, nullum *Elephantem* ibi poſtea ſepultum eſſe. Quid autem vetat, his exteris Medicis *Germanum* jungere, *Hermannum Conringium*, qui in Conjecturis de Antiquiſſimo Statu *Helmſtadii* & Viciniæ, Noſtras quoque Regiones *Diluvio* inundatas probaturus, Triplici potiſſimum Argumentorum genere pugnat, ex *Marinis Conchyliis*, *Oſſibus Belluarum*, & *Arboribus* ſive integris ſive partibus, quæ cum in altiſſimis Montium jugis tum ſub Terræ locis profundiſſimis reperiuntur, petito: nec ea inter præterit *Sudem in Sepis uſum paratam*, *Cornu item uri*, *quæ* Thuringi *profundiſſimis Saxorum Cavernis repererunt*, quorum iſtam *Salzæ*, quæ vix unius Horæ Spatio *Tonna* diſtat hoc in monte *Seebergenſi*, *Gothæ* noſtræ Vicino (unde etiam *Conchylia* elegantiſſima eruuntur) extitiſſe memorat *Albinus* in Miſnentium Montanorum Chronico Tit. 22. n. 7. quibus addi forſan merentur Arborum Folia, Lignorum Faſciculi, & Spicæ Culmis adherentes, quæ omnia petrefacta in Lapidicinia *Tonnenſi*, non admodum brocul a Monte noſtro, reperta ſunt. Singularis quoque eſt conringii Obſervatio, his Verbis p. 37. expreſſà: *Sunt porro* Arbores *illæ fere omnes uno quaſi eodemque collocatæ ſitu*, *Radice nempe inter ſeptentrionem & occaſum*, *Cacumine inter orientem et meridiem porrectis cujus cauſam non profecto ulla vere ſimilitudine dixeris* Jocantem Naturam. *At proſtratas* Arbores *a Paludoſa Terra*, per Oceani Septentrionalis Cœcia *aut* Cauro, *Ventis agitati ſuperjecta*, *id ſaltem quam ſimillimum eſt vero*: *Præſertim quum ex illa Cœli Plaga et illis Ventis ſævientibus*, *hodieque omni* Germanicæ Maritimæ Oræ, *pericula inundationum plerumque creari ſoleant*. Novum hinc meæ Sententiæ accedit Argumentum, quoniam *Elephas noſter Cornua* ſua verſus Ortum ac Septentrionem protendebat: & quanquam id paulo diverſum videtur a *Conringiano*, Notandum tamen eſt, tantum *Belluam* Mari abreptam ſeſe varie moviſſe, Arbores autem eodem, quo proſternuntur, Situ obrutas jacere. Cæterum *Elephantem* Undis immanibus agitatum non mirum eſt. Situm plane extraordinarium Violentumque tandem acquiſiviſſe, ejuſque Membra putrefacta latius extenſa: Nec alia forſan de Cauſa dentes exerti ſive Cornua introrſum incurvata fuerunt, quanquam eorum ſitus in delineatione capitis *Hybernici* apud *Moulinum* ſimilis fere deprehenditur; accuratius procul dubio expreſſius, niſi pleraque eorum pars aduſta fuiſſet; ut proinde potius a Morte vel Putredine, quam undis fatalibus id derivandum videatur.

Mineral Maps, by Dr. M. Liſter, n. 164. p. 739.

XXXVIII. We ſhall then be better able to judge of the Make of the *Earth*, and of many *Phænomena* belonging thereto, when we have well and duly examined it, as far as human Art can poſſibly reach, beginning from the outſide downwards. For this purpoſe it were adviſable, that a ſoil or mineral Map, as I may call it, were deviſed. It might be diſiinguiſh'd into Countries, with the Rivers and ſome of the noted Towns put in. The Soil might either

be coloured, or otherwiſe diſtinguiſhed by Variety of Lines or Etchings; but the great Care muſt be, very exactly to note upon the Map where ſuch and ſuch Soils are bounded. As for Example, in *Yorkſhire*, 1. The *Woolds*; *Chalk, Flint* and *Pyrites, &c.* 2. *Blackmoore*; *Moores, Sandſtone, &c.* 3. *Holderneſs*; *Boggy, Turf, Clay, Sand, &c.* 4. *Weſtern Mountains*; *Moores, Sandſtone, Coal, Iron-ſtone, Lead-Ore, Sand, Clay, &c.* *Nottinghamſhire*; moſtly *Gravel, Pebbles, Clay, Sand-ſtone, Hall-Plaiſter, or Gypſum*, &c. Now if it were noted how far theſe extended, and the Limits of each Soil appeared upon a Map, ſomething more might be comprehended from the whole, and from every part, than I can poſſibly foreſee, which would make ſuch a Labour very well worth the Pains. For I am of the Opinion, ſuch upper Soils, if natural, infallibly produce ſuch under Minerals, and for the moſt part in ſuch Order.

XXXIX. I have ſome Reaſon to think that Sand was once the moſt *exterior* and general Cover of the Surface of the whole Earth: Becauſe all our *Northern Mountains* are more or leſs covered with it at this Day, and the higher the Mountains, ſtill the more, and the courſer the Sand: Becauſe the Rivers ariſing in the Mountains do yet daily bring it down in great Quantities; and that it has been ſo in all probability, in all Ages, ſince the firſt Rains fell upon the Face of the Earth, ſeems to me to be truth-like, in that the Sea-ſhores, or Mouths of Rivers, are uſually barr'd with it, beſides the ſandy ſea Grounds in moſt places of the Sea; and which ſeems a clear Evidence for the length of Time (for that the low Ground near theſe Rivers, which have been in all Ages upon Record, *Moſſes*) if you pierce ſo deep into them, as to diſcover their Bottom, you meet with this Mountain *Sand* in great Quantities, and in ſome places a Moſs under that, and the ſame Sand-bed under that. Now if we conſider how long theſe Moſſes or Turf is in growing, it being moſtly the Leaves and Roots of Plants, we muſt allow very many Ages for this purpoſe. And altho' *Herodotus* one of the moſt ancient Hiſtorians that are, boldly conjectures that the *Nyle* in *Ægypt*, long before our times, would be dammed up and uſeleſs by the great Plenty of Mud yearly brought down that vaſt River; yet it does not appear, that the Country is much different from what it was in his Time; ſo that the Sand and Mud is ſtill carried to Sea.

Schemes of Sands, &c. Clays; *By Dr.* Liſter, n.164. p 740.

Another Argument of the Sand's being the univerſal Cover of the Face of the Earth is, from the great Hardneſs, and conſequently the Durableneſs and unalterable Quality of this Mineral, above any other in Nature. For tho' many things are called Sand, from the Smallneſs and little Coheſion, or Dryneſs of the Grains, yet this kind of Mountain-Sand above all others, keeps its natural and original Magnitude; and is not made (as moſt Sand is) by the Attrition or Wearing of one Particle of Stone againſt another, but is of a conſtant and durable Figure; and therefore I ſay, it ſeems to me for this Reaſon, to be the moſt fit for an Outſide or Cover to the Globe of the Earth.

It may be objected, that the uppermoſt Beds of Stone on the *high Woolds* all over *England*, are ſoft *Chalk*, and on the ſmooth Surface no Appearance of *Sand*. This indeed is in part granted; but that there is no where any *Sand* upon the *Chalk Mountains*, is not true; for to inſtance in thoſe inland *Sand Hills*, above *Bulloigne* in *Picardy*, which *Sand* is the very ſame with that on the Sea-ſhore at *Calais*, and although this is not *England*, yet the Sea hath but accidentally divided us. For from *Dunſtable* in *England*, even as far as the Walls of *Paris* by *Calais*, is, as it were a continued *Woolds* of *Chalk* and *Flint*. What Difference there is betwixt the *Woolds Mountain-ſand*, and that of the *Northern Mountains*, will beſt appear in the Table. Now the Nakedneſs of the *Woolds* is from the ſmallneſs of its *Sand*, which readily yielded not only to the *Rain* that fell, but to the Wind alſo. Which is evident from that vaſt Tract of *Sandy Hills*, which bound the Coaſt of *France*, *Flanders* and *Holland*, and which have made their Coaſt ſo ſhallow in reſpect of ours, as being in great part blown off the *Yorkſhire*, *Lincolnſhire*, *Suffolk*, or *Eſſex* and *Kentiſh Woolds*, and wrapt up upon their Coaſts; and the Reaſon of this is partly from the more conſtant *Weſterly Winds* blowing over from our Coaſts; and alſo from the meeting of the two Tides, *viz.* That of the *Channel*, and that other of *North Flood* upon their Coaſts.

I am very well aware, that the finding of *Cockles* or *Shells*, as moſt Writers are pleaſed to call them, upon Mountains, and Sand alſo there, is by the ſame *Herodotus* uſed as an Argument of a great *Deluge*, or *Inundation* of Waters; but as I have elſewhere, I think, demonſtrated, that the Rock *Cochlites*, are no Shells, ſo neither can I grant that the *Sand* was adventitious to the Mountains, but naturally originated there; for that it is there plainly to be found, ſome looſe, and the reſt in Beds, yet unlooſened, as I could name very many Places; for inſtance, on *Silden* and *Thorp Fells* in *Craven*, this Mountain-ſand is a white and tranſparent Pebble, and as ſome of it is ſmall, and eaſily ſwept and blown away, ſo is there much of it upon the high Mountains mixt with white Pebbles of greater Size.

'Tis the Character of this Sand not to yield to Fire, as *Flint* will do; and tho' it agree with that and ſome other Metals to ſtrike Fire from *Steel*, yet it does not calcine, as *Flint* will be brought to do. And therefore this Sand is the true *Tarſo* of the *Italian* Mountains, of which the fine *Venetian Glaſs* is made; and for this Reaſon the *Flint Glaſſes* were here in *England* ill compounded, the Foreigners miſtaking the Materials, which yet our Country affords in Plenty all over the Northern, and (I doubt not) the Weſtern Mountains too: I have ſeen from the *Scots* Mountains very excellent and large.

A TABLE of Sand *(drawn up about the Year 1673.) Such chiefly as I have found in the* Northern *Parts of* England.

- *Sand*
  - *Sharp*, or *Rag Sand*, compoſed of ſmall Tranſparent *Pebbles*, naturally found upon the Mountains, not Calcinable.
    - *Fine*
      - *Fine*
        - *White*
        - *Gray*
        - *Reddiſh*
        - *Brown*
          - *Stitnham-Moor* in the Road waſh'd up very *White Pebble.*
          - *Flamborough Head*, of which the Light Houſe there is cemented.
          - *Calice Sand*; burns Reddiſh, but falls not in Water.
          - *Seaton-Banks* near *Hartlepool*, on the *Tees Mouth*;
          - *Eſcrick* in the Gravel Pit there; A Vein of exceeding fine Sand.
          - The *Pillow Sand* in the *Baltick.*
          - In a Spring at *Heſlington.*
          - The *Sand* at the *Bath* in *Somerſetſhire.*
          - *Acome* near *York*, drifted Sand.
          - *Hutton Moor* Waſht.
      - *Courſe*
        - *Greiſly*
        - *Brown*
          - *Threp* Fells.
          - *Owze* at *York.*
          - *Nid* at *Mountain.*
          - Dug up at *Rawcliff* near *Snath.*
          - *Wharfe* at *Ickly* and *Denton.*
          - *Air* at *Carleton* in *Craven.*
          - *Eure* at *Craven.*
          - *Gauton.*
          - *Santon* in *Lincolnſhire.*
          - *Bromeby Common.*
          - *Skipwith Common.*
  - *Soft*, or *Smooth* with *Flat* Particles.
    - From *Lime-ſtone* with *Mica* of *Glittering* Particles.
      - At —— in *Yorkſhire.*
      - A Vein at *Oſwell-Beacon* in *Lincolnſhire*

- Of *Weſtmorland.*
  - *Silver-like*
  - *Gold-like*
    - *Sea-ſand* about the *Scilly Iſlands.*
    - In *Cleveland*, and about *Scarborough.*
    - *Ouze* Duſt or Sediment at *Rawcliff.*
    - A Vein of *Mica* in *Heſlington* Gravel Pit.
    - *Mica Argentea* in *Red-ſand Rock*, near *Rippon*, plentifully.
    - *Mica Aurea* of *Cleveland.*

Clay ſeems to be another Coat of the Terreſtrial Globe in the more depreſſed and hollow parts thereof. The Mixture of Sand and Clay is not unuſually called Earth: Yet this Term being too large, it will be convenient, as I think, to limit it to ſuch a Mixture as we uſually find upon the ſurface of the Ground, which hath ever in it, beſides ſuch Sands and Clays, as either the Soil naturally produces, or have by Floods and Winds, or other Accidents, being brought thither, a great part of the rotten parts of *Plants* and Animals; And in this Senſe, Turf is Earth, which is moſtly where the *Erica* or *Heath* grows, becauſe 'tis made up of the deciduous Leaves of that Plant, which being by the Current of Showers brought together, make up the Moors, Moſſes and Fens. and in the Mountains, in hollow Baſons or Depreſſures without Vent, Moſſes of incredible Depth; 1 or 2 Fathoms ordinarily in the ſame kind of black Earth, called *Peat* or *Turf.*

A Table of Clays.

- Clay
  - Pure, that is, ſuch as is ſoft like Butter to the Teeth, and has little or no Grittineſs in it.
    - *Greaſy*, to be reckoned amongſt the Medicinal Earth, or *Terra ſigillata*.
      - 1. *Fuller's Earth.*
        - *Yellowiſh*
          - At *Brickhill* in *Northamptonſhire.*
          - At .. under the *Yorkſhire Woolds.*
        - *Brown*, about *Hallifax.*
        - *White*, in *Darbyſhire Lead-mines.*
      - 2. *Boli*
        - In *Cleveland.*
        - At *Linton* upon *Wharfe.*
      - 3. *Pale Yellow*, in the *Marle Pit* at *Ripley.*
      - 4. *Cow ſhot Clay*, or the Soap ſcale lying in *Coal-mines.*
      - 5. A *dark blew Clay*, or *marle* at *Tolthrop.*

Harſh

- Clay
  - Harſh and Duſty when Dry.
    - 6. *Creta* properly ſo called, or the Milk White, Clay of the *Iſle of Wight*.
    - 7. The Potter's *Pale Yellow* Clay of *Wakefield Moor*.
    - 8. The Blew Clay of *Bullingbrook* Pottery in *Lincolnſhire*.
    - 9. A Blew Clay of *Bugthorp Beck*, in which the *Aſtroites* are found.
    - 10. Yellow Clay in the Seams of the Red Sand Rock at *Bilbro*.
    - 11. Fine Red Clay in the Red Sand Rock at *Bilbro* and *Rippon*.
    - 12. A Soft Chalky Blew Clay. } at *Buttercrain*.
    - 13. A Soft Chalky Red Clay. } at *Buttercrain*.
  - Stony when Dry.
    - 14. A Red Stone Clay. } In the Banks of *Whitear-Beck, near Leppington.* and at *Houſam* in the *Milſcar*
    - 15. A Blew Stone Clay. } In the Banks of *Whitear-Beck, near Leppington.* and at *Houſam* in the *Milſcar*
    - 16. Clunch, a White Stone Clay in *Cambridgeſhire*
  - *Mixt*
    - With Round, Sand, or Pebble.
      - 17. The Yellow Loame of *Skipwith Moor* in *Yorkſhire*.
      - 18. A Red Sandy Clay in the right hand bank ot the Road beyond *Collingham* near the *Lime Kilns* going to ——
      - 19. A Red Sandy Clay in the Red Sand Rock near *Rippon*.
    - With Flat or Thin Sand, Glittering with Mica.
      - 20. Crouch White Clay in *Darbyſhire*, of which the Glaſs-Pots are made at *Nottingham*.
      - 21. Grey or Blewiſh *Tobacco* Pipe Clay at *Hallifax*.
      - 22. A *Red Clay* in the *Red Sand Rock* at *Rotherham*.

XL. Theſe Wonderful Sands have not yet exceeded one Century, ſince they firſt broke Priſon. Their Original is in a Warren in *Laken Heath* (a Town belonging to the *Dean* and *Chapter* of *Ely*, diſtant not above 5 Miles and lying Southweſt and by Weſt of this Place;) where ſome great Sand Hills, (whereof there is ſtill a Remainder) having the Superficies, or Swerd of the Ground, as we call it, broken by the Impetuous Southweſt Winds Blew upon ſome of the Adjacent Grounds; which being much of the ſame Nature, and having nothing but a thin cruſt of Barren Earth to ſecure its good Behaviour, was ſoon rotted and diſſolved by the other Sand, and thereby eaſily fitted to increaſe the Maſs, and to bear it company in this ſtrange Progreſs.

A Sand-flood at Downham in Suffolk, By Mr. Tho. Wright. n. 37. p. 722.

At the firſt Eruption, I ſuppoſe the whole Magazin of Sand could not cover above 8 or 10 Acres of Ground, which increaſed into 1000 Acres, before the Sand hath Travail'd 4 Miles from its aboad. All the oppoſition it met with in its Journey hither, was from one Farm-Houſe, which ſtood within a Mile and a half from its firſt *Source*. This the owner at firſt endeavoured to have ſecured by force and building of Bulworks againſt the Aſſaults thereof; but this wing'd Enemy was not to be ſo oppoſed: Which, after ſome Diſpute, the owner perceiving, did not only Slight the former Works, but all his Fences, and what elſe might obſtruct the Paſſage of this unwelcome Gueſt, and in 4 Years effected that by a Compliance and Submiſſion, which could never have been done upon other Terms; in which he was ſo ſucceſsful, as that there is ſcarce any Foot Steps left of this miſchievous Enemy.

'Tis between 30 and 40 Years, ſince it firſt reach'd the Bounds of this Town; where it continued for 10 or 12 Years in the Out-skirts, without doing any conſiderable Miſchief to the ſame. The Reaſon of which I gueſs to be, that it's current was then down Hill, which ſhelter'd it from thoſe Winds that gave it Motion. But that Valley being once paſt, it went above a Mile up Hill in 2 Months time, and overran 200 Acres of very good Corn that ſame Year. 'Tis now got into the Body of this little Town, where it hath buried and deſtroy'd divers Tenements and other Houſes, and has inforced us to preſerve the Remainder at a greater Charge than they are worth. Which doubtleſs had alſo periſhed, had not my Affection to this poor Dwelling obliged me to preſerve it at a greater Expence than it was built. I have at laſt given it ſome Check; for by ſtopping of it 4 or 5 Years (what I could) with *Furze* Hedges ſet upon one another, as faſt as the Sand levell'd them (by which I have raiſed Sand-Banks near 20 Yards high) I brought it into the Circuit of about 8 or 10 Acres, and then in one Year, by laying ſome hundred Loads of Muck and good Earth upon it, I have again reduced it to *Terra firma*, have cleared all my Walls, and by the Aſſiſtance and Kindneſs of my Neighbours (who helped me away with above 1500 Loads in one Month) cut a Paſſage to my Houſe through the main Body thereof.

At the other end of the Town divers Dwellings are buried or overthrown; and our *Paſtures* and *Meadows* (which were very conſiderable to ſo ſmall a Town, both for Quantity and Quality) over-run and deſtroyed: And the Branch of the River *Ouſe* upon which we border, (being better known by the Name of *Thetford*, or *Brandon* River, between which Two Towns, we lie) for 3 Miles together is ſo filled with Sand, that now a Veſſel with two Load Weight paſſeth with as much Difficulty as before with 10. But had not the Stream interpoſed, to ſtop its Paſſage into *Norfolk*, doubtleſs a good part of that Country had ere now been left a deſolate Trophy of this conquering Enemy. For according to the Proportion of its Increaſe in theſe 5 Miles, which was from 10 Acres to 1500, or 2000; in 10 Miles more of the ſame Soil, it would have been ſwell'd to a great Vaſtneſs.

It is obſervable, that the ſituation of the Country in which this troubleſome Gueſt firſt took his *Riſe*, lies *E. N. E.* off a part of the *great Level* of the *Fenns*, and is thereby fully expoſed to the Rage of thoſe impetuous *Blaſts* we yearly Receive out of the Oppoſite Quarter: Which I ſuppoſe acquire more than an Ordinary Vigour by the *Winds* paſſing through ſo long a Tract, without any Check. Another thing which Contributes to it, is, the Extream *Sandineſs* of the Soyl, the Levity of which I believe gave occaſion to that Land-ſtory of the Actions that uſe to be brought in *Norfolk* for Ground blown out of the Owners Poſſeſſion.

XLI. Beſides the *Bolus Armenus*, and the *Terra Sileſiaca*, there is an Earth found in *Hungary* about the River *Tockay*, thence called *Bolus Tockavienſis*, having as good Effects in Phyſick as either of the former.

An Hungarian Bolus; *By* . . . . n. 1. p 11.

XLII. *Soap Earth* is found only in two places near *Duraclea*, a large open Village, about 6 Leagues to the Eaſtward of *Smyrna*; and in a very Flat Plain, about a League Weſtward of the River *Hermus* and ſeveral Leagues from the Sea. 'Tis a Fine *Soap*, and at the firſt gathering Whitiſh Earth, which boileth or ſhoots up out of the Earth. 'Tis gathered alway before Sun-Riſe, and in Mornings when there falls no Dew, ſo that a Stock muſt be laid up for the whole Year in the Summer Months. It comes up in ſome places an Inch or two above the Surface of the Ground. But the Sun Riſing upon it, makes it to fall down again. Every Morning there is a New Crop, tho' all be taken away which the preceeding Day afforded. The Earth Producing it lies low in both places, and is in the Winter Waſhy; 'tis cover'd, tho' but thinly, with Graſs.

The Soap-Earth *from* Smyrna; *By Dr.* Edw. Smith. n. 220 p. 228.

Three Hundred Drams of this Earth put into a *Retort in Balneo Arenæ* for 12 Hours *cum Igne Violento*, gave between 5 or 6 Ounces of an *Inſipid Phlegma*, the ſmell only ſuch as proceeds in ſuch Operations from the Fire.

Finding therefore no *Volatile Salt*, as what muſt have come over by the foregoing Experiment; 200 Drams Calcin'd at a *Bagnio Fire*, in a *German Crucible*, were diſſolved in Water. The Compoſition of Earth and Water, boyl'd into a *Lixivium*, made 500 Drams.

It was boyl'd for Three Hours, ſtill Scuming off the Froth, then *Filtrated*, after *Evaported* over a Gentle Fire, it was kept to *Chryſtallize*, and appear'd of a Fix'd Salt.

At the *Soap Houſes* they mix ¾ of Earth with ¼ of Lime and diſſolve the Compoſition in boyling Water; where ſtirring it often with a Stick there Floats a top a thick browniſh Subſtance, which *Scumming* off they preſerve in Baſons apart, and this *Scum* is much Richer than the Liquor underneath; yet both are uſed in making the Soap. Into a large Copper Caldron they put 50 Kintals of Oyl, applying a very hot Fire, which burns continually until the Soap is made. When the Oyl has boyl'd, they begin to throw in of the Scum, and ſometimes of the Liquor from which the Scum was taken. They often repeat this throwing in of the Scum and Liquor for 13 or 14 Days, in which time the Soap is uſually perfected. The Browniſh Scum, and what is uſeful of the Liquor, incorporating with the Oyl, what is uſeleſs Sinks to the bottom of the Caldron, where it is let out to make Room for throwing in more. The Water thus let out is again thrown upon a new Compoſition of Earth and Lime, but when the Liquor becomes wholly Inſipid, 'tis then judged to be Exhauſted. After 13 or 14 Days when the Soap is finiſhed, 'tis laded out of the Boiler, and laid upon a Lime Floor to dry.

They proportion two Load of Earth of five Kintals each, to 50 Kintals of Oyl; the Produce is between 70 and 80 Kintals of Soap.

The Earth is bought at a Dollar a Load and the Soap when this Account was made, at 6¼ a Kintal. There is imploy'd in making Soap Yearly at *Smyrna* 1000 Kintals of Oyl.

Bringing Soap Earth employs 1000, or 1500, Camels Dayly for eight Months; the four Summer Months being too hot for Camels to Travel.

An ordinary Soap-Houſe produces 1000 Dollars a Year clear Profit, *communibus Annis*.

The Uſe of Turkiſh Reſma; *By Mr.* Smith. n. 243. p. 295:

XLIII. This Black Earth, which is call'd *Ruſma*, and ſeems as if it were Burnt, muſt be beaten in an Iron or Marble Mortar to a fine Powder and ſifted diligently; when you uſe it take one part of the ſaid Powder, and two parts of unſlacked Lime, put theſe mix'd together into a Linen Rag, which infuſe in warm Water the ſpace of a *Quarter* of an *Hour*, or till it becomes of a black Colour, then apply it to the Place from whence you would take the Hair; as ſoon as the Hair begins to be looſe, the Part muſt be waſhed with warm Water and Soap.

Coal-Mines *in* Somerſetſhire; *By* Mr. J. Beaumont. *Ph. Col.* n. 1. p. 6:

XLIV. Within 5 Miles Northward of *Stony Eaſton*, there are 6 diſtinct Coal-Works. The chiefeſt Obſervables I met with in them are,

1. The Branched Clift, which uſually lies over the Coal, and is all wrought with the Repreſentations of ſundry ſorts of Herbs.

2. A Clift all Interwoven with *Arboreſcent Marchaſites*, which commonly lies over the former, and is call'd by our Colliers the Thorny Clift.

3. We here Obſerve, that ſome Coal Veins are much more tinged with *Sulphur* than others; a Vein being wrought in one of theſe Works ſome Years ſince, which received ſuch a Reſplendency from its Sulphury Tincture, that in all its Joynts it ſeem'd as though it were cover'd with Leaf Gold, and hence by the Colliers it was call'd the *Peacock Vein*.

4. I may here take Notice that about four Years ſince in one of theſe Works was found about 2 or 300 Weight of very good *Lead Ore* growing to a Vein of Coal, the *Ore* being tinged ſomewhat Yellow by the Sulphur: We look upon this as a Rarety with us, none ever having been found in a Coal Pit before; the Sulphurous Spirit being there generally too ſtrong for the Generation of that Metal.

A Subterraneous Fungus; *By* Mr. Jeſſop. n. 100. p. 6179.

XLV. 1. The *Fungus Subterraneus* I ſent you a large Quantity of, was gotten in a Rocky Lime-ſtone Ground, on a Common about two Miles diſtant from *Caſtleton* in the *Peak* of *Darbyſhire*, 15 or 16 Yards Deep, in the *Old-man* (as they call a Mine formerly wrought and ſtopt up) cover'd with Earth, and that had either fallen or was thrown in. There is no Coal-Bed, that is known of, within 5 or 6 Miles of the Place.

2. The Pieces of this *Fungus* which I received, are much like, *Peats*, or *Turff*, cut up in the High Moors, both in the Sooty Colour and inward Subſtance; This only is more Clammy and Tough, and dries not. And ſome of this *Fungous* Subſtance is very Soft and like Gelly. In and about the more Solid Pieces, (of which I have ſome, half a Foot ſquare) are many big Lumps of a *Bituminous* Subſtance. This *Bitumen* is very Inflammable like Roſin; it is very light, it breaks firm, and ſhines like good *Aloes*; and for Colour'd it is not much unlike it, ſave that it is more dark colour'd and Purpliſh; yet there is much of it of a dark green Colour. We diſtill'd a parcel of it, which yielded us an *Acidulous Limpid Water*; when a White Liquor, which was, I gueſs, from ſome of the Oily parts Precipitate; and in the laſt place, a Copious Yellow Oil, not unlike that of *Succinum*, or Pitch. In the Neck of the *Retort* we could diſcern no Volatile Salt, as in the like Proceſs upon *Amber*. I have not Read of any ſuch *Fungous* Earth, in which *Bitumen* naturally grows and adheres: And the finding of it in an *Old Mine*, doth much favour an Opinion of its being a Vegetable Subſtance, either the very Subſtance of the Props of Wood, they make uſe of in lining and ſupporting the *Grooves*, thus altered, or certain *Fungus*'s growing out of them. That Birch, (of which there is great Plenty, and hath been vaſt Woods, all theſe Mountainous Parts of *England* over) will yield a *Bitumen*, as *Limpid* as the Sap is which runs from it by tapping, if we now had the Skill to extract it. *Pliny* is very expreſs *l.* 16. *c.* 18. *Bitumen ex Betula Galli excoquunt*. And moreover it is certain that much of that Wood, if not all, which is dugg up in the High Moors of Craven, and which the People there call and uſe for *Candle Wood*, is no other than Birch, as it appears from the Grain and Bark; and yet this Wood kindleth, Flames, and Exudates a *Roſin*, which makes many pronounce it very Firr Wood. Whatever this *Bitumen* is, which this *Fungus Subterraneus* yields, it much differs from the *Aſphaltum* of the Shops.

By Dr. Liſter ib. p. 6180.

XLVI. Mr. *Jeſſop* ſends me Word, that Capt. *Wain* has given him a White Liquor reſembling Cream both in Colour and Conſiſtence, which he found in great Quantities at the bottom of a Coal-Pit 49. Yards deep. And Mr. *Geo. Planton* Writes from *Sheriff Hales* in *Shropſhire*, that in the Iron-Mines, eſpecially what which the Country People there call the *White-Mine*, which yields the beſt Iron Stone, the Miners do commonly, upon the breaking of a Stone, meet with a great quantity of Whitiſh Milky Liquor, incloſed in the Center of it; they ſometimes find a Hogſhead contained in one Cavity. 'Tis in Taſte ſweetiſh; only it hath a Vitriolick and Iron like Twang with it.

A Mineral Juice; *By Dr.* Liſter. ib. p. 6181.

XLVII. In *Broſely*, *Bently*, *Pitchford*, and other Places adjacent in *Shropſhire*, there lies over moſt of the Coal-Pits or Mines, a *Stratum* or Layer of a Blackiſh

A Blackiſh Stone in Shropſhire, yielding Pitch, Tar, *and* Oyl; *By* Mr. Martin Ele. n. 28. p. 5442.

Blackiſh Rock, or Stone, of ſome thickneſs, which is Porous, and contains in it great quantities of *Bituminous* matter.

This Stone being brought to the Work Houſe is ground ſmall by Horſe Mills, ſuch as are uſed for grinding Flints to make Glaſs of; the Powder is thrown into great Coppers of Water, where by boiling, the *Bituminous* Matter is ſeparated from the Stony or Gritty, this laſt ſinking to the bottom the other ſwimming at the top of the Water.

This *Bituminous* Subſtance being gathered together and Evaporated, comes to the conſiſtence of Pitch, and with the help of an Oyl diſtill'd from the ſame Stone, and mixed with the Pitch comes to be thinner, or like *Tarr*; the uſes of both which Materials, either for Shipping or otherwiſe, theſe Subſtances are ſaid to ſupply, nay even go beyond. And this has been tried on ſeveral Boats this 3 or 4 Years paſt, and does not Crack as the ordinary Pitch or Tarr, but always keeps black and ſoft, and therefore is propoſed to hinder the Worm from getting into the Ships Pitched with it.

There is likewiſe diſtill'd from this Stone, an Oyl which may be uſed for Oyl of Petre, or Turpentine, and has been tried by divers Perſons in Aches or Pains.

A Mineral Balſam in Alſatia; By ... n. 8. p. 135.

XLVIII. In the Valley call'd *Liberthal*, near *Geesbach*, (an ancient Mine Work in *Alſatia*) there runs out of a Cavern a Foul, Fattiſh, Oily Liquor, which affords an excellent *Balſam*, by taking a Quantity of it, and putting it in an Earthen Pot well luted, that no ſteam may Exhale; and then with a Gentle Fire at firſt, but a ſtronger afterwards, boiling it for 3 Hours together, in which ſpace it will boil in a 4th part, and an Earthen matter, like Pitch, will ſettle it ſelf at the bottom; but on the Top thereof, when cold, there will ſwim a Fatty ſubſtance, like Line Oyl, limpid and ſomewhat yellowiſh, which is to be decanted from the thick Sediment, and then gently diſtilled in an *Alembick* in *Arena*; by which means there will come over two differing Liquors, one *Phlegmatick*, the other Oily, which latter ſwimming on the *Phlegm*, is to be ſevered from it. The *Phlegm* is uſed as an excellent Reſiſter and curer of all the Putrefactions of the Lungs and Liver, and it heals all Foul Wounds and Ulcers. The Oily part, being diluted with double its quantity of diſtilled Vinegar, and brought 3 times over the Helm, yields a rare Balſam againſt all inward and outward Corruptions, ſtinking Ulcers, Hereditary Scurfs and Scabs. 'Tis alſo much uſed againſt Apoplexies, Palſies, Conſumptions, Giddineſſes, and Headaches. Inwardly they take it with *Succory Water* againſt all Corruptions of the Lungs. It is a kind of *Petroleum*, and contains no other Mineral Juice but that of Sulphur, which ſeems to be thus diſtilled by Nature under Ground; the Diſtillation of an *Oyl* out of Sulphur by Art, not being ſo eaſy to perform.

A Mineral Balſam in Italy; By S. M. Antonio Caſtagna. n 79. P. 3059.

XLIX. In the Territory of *Bergamo* Sig. *M. Ant. Caſtagna*, upon the Confines of his *Juriſdiction*, lighted accidentlly upon a not ordinary ſweet *balſamick Scent* which directed him to a *Rocky Hill*, where he found the *Stones* harbour'd that Fragrancy, which was ſo ſtrong, and by Trials found ſo Friendly to the

Uterus, that being applied, they did in a very ſhort time cure it of any Evil, 'tis ſubject to. Encouraged hereby, he made his Workmen dig into the very Bowels of the Hill, where he diſcovered Holes in ſome Stones, as if excavated by Art, of a greeniſh Colour, in which he found, as diſtilled by Nature, and kept in Veſſels, that *Liquor* and *Balſam*, which proved the ſource of that *Scent*, which was limpid, and of a white Colour, like the White of an Egg, but ſomewhat *Oleaginous*, floating upon all ſorts of Liquors like *Oyl*. Beſides, he met in the ſame Cavities ſome ſmall Grains concreted of the ſame Liquor, reſembling that which they call *White Amber*, which being chymically diſtill'd, had the ſame Odour with the Balſam.

L. I find that *Oſteocolla* grows in a ſandy, yet not gravelly Soil, and not at all that (I know) in any rich or clayie Ground. It ſhoots down 2 Mens depth under Ground; the Branches moſt commonly growing ſtraight up, yet ſometimes alſo they ſpread ſideways: The Branches are ſome of them thicker, ſome ſlenderer and they farther they are diſtant from the common Stem, the thinner they are; the Stalk being thickeſt of all, uſually equalling the Thickneſs of an ordinary Arm or Leg, and the Branches the Thickneſs of ones little Finger.

Oſteocolla *about* Franckfort *on the* Oder, *by* J. Chriſtopher Beckman, n. 39. p. 771.

Upon the Sand which is here every where yellowiſh, there appears a whitiſh fatty Sand, which if it be dug into, hath under it a dark, fatty, and how hot and dry ſoever the other Sand be, a ſomewhat moiſt and putrid Matter, like rotten Wood; which Matter ſpreads it ſelf here and there in the Earth, juſt as the *Oſteocolla* it ſelf doth, and is called by thoſe whom I have employed to look for it, the Flower of this Subſtance. The *Oſteocolla* being thus found, is altogether ſoft yet rather friable than ductile: Wherefore if one hath the Curioſity of getting out of the Ground a whole piece of it with its Branches, he muſt very carefully remove the Sand every way from it, and then let it lie ſo a while; its Quality being, that remaining expoſed to the Sun for half an Hour, or ſomewhat longer, it grows to that Hardneſs as 'tis found in the Shops.

It ſeems to be a kind of *Marle*, or to have great Affinity with it, of which we here have alſo great Store, yet not near thoſe Places where I have found *Oſteocolla*. It requireth alſo time to come to Maturity, which appears from hence, that in the very ſame Place where I digg'd ſome of it laſt Year, I this Year found other, yet with this Difference, that thoſe grew hard, after the manner before deſcribed, but theſe remain ſtill ſoft and friable, tho' now in the 5th Month.

The Cauſe of its being divided into ſo many Branches, I conjecture to be from the Roots, which ſpread themſelves here and there in the Earth, ſo that the Matter gathers and ſettles it ſelf about them, and afterwards according to the Diviſion of the Roots, acquires a plantal Form and Appearance. Whence it ſeems alſo to proceed, that thro' the midſt of the *Oſteocolla* there always paſſeth a dark Line, which is thought to be a piece of the *Root*. And it often happens, that that Stroke loſeth it ſelf by little and little, and the *Oſteocolla* in the middle grows clear; which comes to paſs when the Root by the Corruption begun in the *Oſteocolla* is reduced to Powder. Yet have I found a Place hereabout, where the *Oſteocolla* was not hollow at all; but there I obſerved, that inſtead of ſettling about a big Root, it had gathered it ſelf about many ſmall Fibres; whence alſo this ſort had acquired Pores through its whole Length, but no Cavity like the other.

Black Lead, by Dr Pet, n. 240. p. 183.

LI. The Mineral Subſtance call'd *Black Lead*, found only at *Keſwych* in *Cumberland*, and there call'd *Wadt* or *Kellow*; by Dr. *Merret*, *Nigrica Fabrilis*, from its uſe in ſcoring, as the *Rubrica Fabrilis*, or the *Red Ochre* is; is certainly ſo far from having any thing of Metal in it, that it has nothing of Fuſion, much leſs Ductility; nor can it be reckoned among the Stones, for want of Hardneſs; it remains therefore that it muſt have place amongſt the Earths, tho' it diſſolve not in Water, as moſt Earths will, except ſtiff *Clays*, and *Ochres*; among the latter whereof I gueſs it may be reckoned, it ſeeming to be a ſort of cloſe Earth, of very fine and looſe parts, ſo burnt that it is become black and ſhining, diſcolouring the Hands as all the *Ochres* do; whence the moſt proper Name that can be given it perhaps, may be *Ochrea Nigra*, or *Black Ochre*, being a ſtony ſort, as there are ſtony ſorts of the *Red* and *Yellow Ochres*, as well as Clay.

Iriſh Slate, by . . . . n. 243 p. 271.

LII. It having been diſcourſed to the *Philoſophical Society* at *Oxford*, by Mr. *Henwrick* Phyſician at *Worceſter*, that the *Iriſh Slate* pulveriz'd, and infuſed in Water for a Night or leſs, would impart its *Vitriolick Quality* ſo far forth to it, that it would ſtrike of a faint reddiſh Colour with Powder of *Galls* (as the *vitriolick Waters* of *Tunbridge*, *Aſtrop*, and divers others do) it led me to believe that theſe Waters, ſome of them, might as well iſſue from *Salt* as an *Iron Ore*, unleſs it ſhould appear, that this ſort of *Slate* were an *Iron Ore* too, which put me upon calcining it for 3 or 4 Hours, after the Manner of Dr. *Liſter*, to experiment whether it would then (like other *Iron Ore*) apply to the *Magnet*; wherein altho' I was altogether unſucceſsful, the *Magnet* not taking the leaſt Notice of it, yet it afforded me another Diſcovery altogether as ſatisfactory, *viz.* that upon Torrefaction, it was all become a *Yellow Ochre*, and would ſcore like it, which further perſwades me, that the *Yellow*, or rather *Orange colour'd Sediment* we find at the Bottom of theſe *Fountains*, comes rather from this ſort of *Slat*, than an *Iron Ore*; for I much queſtion, whether ſome of the *Yellow Ochres* (tho' it's plain the red ones do) come from, or are, *Iron Ores*, becauſe the *Shot over Yellow Ochre* will not own the *Magnet* after 36 Hours Calcination, or better.

Chalk, and ſome other Bodies not properly *Stones*, tho' commonly reputed ſo, By Dr *Fr. Slare*, n. 152. p. 114.

LIII. In a ſmall Treatiſe of the *Calculus Humanus*, I found reaſon to complain of the Impoſition of our Senſes upon our Conceptions, in calling that a *Stone* by its external Appearance, when it has no real Properties of a *Stone*. I have alſo, in this, Reaſon to except againſt *Chalk*, commonly taken for a *Stone*, for being brought to the *Hydroſtatical Examen*, (if that may be allowed as a Standard) it wants much of the true Conſiſtence of a Stone, for it wants much of that weight, which real Stones are proved to have in *Water*, and it may perhaps be better reckoned amongſt *Boles* than *Stones*. I found this true not only in Chalk, but various other Bodies taken for granted to be *Stones* at large: Some of which are nearer *Earths* than *Stones*, others have nothing but *Earth*, *Sulphur*, and *Metal*, and yet muſt be called *Stones*, (as all *Marchaſites* are; Of theſe the former, (namely the *Boles*) many of them fall ſhort of our Standard of *Stone*, others are more ponderous, and ſo exceed our Standard, whereas true Stones, tho' differing much in Hardneſs, whether *Pebbles*, *Flints*, *Petrefy'd Waters*, &c. do anſwer the ſame Standard of *ſpecifick Gravity* that a *Diamond* does; which is, as about 2½ to 1.

Imperfect *Stone in Scotland* by *Dr. Geo.* Gorden, n. 175. p. 1157.

LIV. Upon the River *Done* near *Aberdeen*, a little below the Bridge near the River's Mouth, there is a Bank, the Face of which is broken down, and it is full of *Stones*, which one would think were in *fieri*; they are all either round or oval, of different Sizes; the Faces of moſt of them are broken off, they are ſoft, and will eaſily rub down with your Hand, they are of different Gritts and Colours, and are made up of different Sands and Clays mingled together; the Clay is ſoft both to Hand and Taſte, in ſome of them white, in others gray, tho' in ſome Places the Clay and Sand are harden'd to the Conſiſtence and Colour of ſuch oval Stones as we uſually ſee in the Fields; but where they are at the ſofteſt, the Bed that each Stone lies in, is always hard, and of another Grit and Colour.

A *Stone Quarry* near Maeſtricht, *by* . . . . n. 67. p. 2054.

LV. There is an excellent *Quarry* within Cannon-ſhot of *Maeſtricht*, lying in a Hill, where there are about 25 Fathom of Rock and Earth over head; it hath one Entry towards the River *Maeſe*, where Carts can paſs with great eaſe, and unload the Stones upon the Brink of the River, the *Quarry* within being parallel to the Horizon, and elevated but very little above the River. It affords one of the moſt ſurpriſing Proſpects, when well lighted with many Torches, that one can imagine. For there are thouſands of ſquare Pillars in large level Walks, and thoſe almoſt every where above 20, and in ſome places many more Foot high; and all wrought with much Neatneſs and Regularity.

This *Quarry* ſerveth the People that live thereabout, for a kind of impregnable Retreat, when Armies march that way. For being acquainted with all the Ways in it, they carry into it whatſoever they would have ſafe as well their Horſe and Cattle, as their moveable Furniture, till the Danger be over; there being ſo vaſt a deal of Room, that 40000 People may ſhelter themſelves in it.

In this vaſt *Grotto* 'tis remarkable, that there is but little Rubbiſh, which ſhews both the goodneſs of the Stone, and the carefulneſs of the *Workmen*. And in divers places there are little *Pools* of *Water*, perhaps made on purpoſe for Beaſts to drink, and to ſerve for other uſes in time of Need: For in no place almoſt are there any Droppings to be ſeen; nor are the Walks at all wet under Foot; only it ſeems, that Rain gets in by the Air Shafts, which for ſaving of Labour, and perhaps too, to make theſe *Pools*, are let down from ſuch Places commonly, as are the *Pools* thereabout; and ſo the Rain, that falls on the higher Grounds, does eaſily find the way thither.

Quarries *and* Rocks *in* Auſtria *and* Hungaria, &c. *by Dr.* Ed. Brown. n. 59. p. 1050

LVI. Upon the North-ſide of Mount *Calenberg*, two *German* Miles from *Vienna*, are Stones mark'd with Trees and Leaves. In the *Hermitage* of the *Camaldulenſes*, ſeated upon a Peak of this Hill, I ſaw fair ones, with which they paved the Walk in their Gardens.

Not far from *Manners Dorf*, is the Emperor's Quarry of Stone, out of which are made the beſt Buildings in *Vienna*: In which, whereſoever there is a Cleft or Separation of one Stone from another, the Water falling betwixt them, leaves a Petrefication, thereby, as 'twere, healing the Wound, by making a ſtony *Callus*, not exactly like the Parts which it joins together.

An *Engliſh* Mile from *Freiſtat* in *Hungary*, Northward, is a *Quarry* of Stone, out of which many great Stones are digged, tranſparent and reſembling *Sugar-candy*.

At *Banca*, two *Hungarian* Miles from *Freiſtat*, Northward, is a Quarry of *White Stone*, nigh the *Hot Baths* of that Place, over which is a Lay of *Chalk*, of about a Yard thick, very beautiful to the Eye, as being of all Colours except Green, ſo finely mixt, ſtreaked and ſhaded, that it ſurpaſſeth *Marble Paper*; and the Water dropping upon it, doth, as 'twere varniſh it.

At *Schemnitz* in *Hungary*, famous for *Silver-mines*, is an high Perpendicular Rock, part of which, from the Top to the Bottom, is naturally tinctured with a ſhining fair blew and green: And I have heard from a *Spaniard*, who lived long in the *Weſt Indies*, that there is alſo a Rock like this nigh to the *Silver-mines* in *Peru*.

The Mountain of *Cliſſura*, being a part of Mount *Hæmus*, as alſo Mount *Pyrlipe* do ſhine like ſilver, and Day and Night, either by the Light of the Sun or Moon, afford a glittering pleaſant Shew, cauſed by the great Quantity of *Muſcovy Glaſs*, wherewith theſe Hills abound. There are alſo *Talcum Rocks* nigh *Spital* in upper *Carinthia*: And a Hill nigh *Sarvizza*, which conſiſts of an Earth of a fine red Colour, out of which the red earthen Veſſels of that Country are made.

White Marble in Ireland, by Dr. *Aſh*, Biſhop of *Cloyne*, n. 243 p. 294.

LVII. A *Quarry* of *White-marble*, is lately diſcovered in the County of *Antrim*, and 'tis of an extreamly fine Grain, ſoft at firſt, but grows very hard afterwards, like *Portland Stone*.

Stones growing at the End of a Ruſh, by *Sir* R. Redding, n. 1[illegible]. p. 663

LVIII. I ſend you herewith ſome Stones of an *Amber Colour*, taken out of a Spring, called *Cranbourn ſpring* near *Lough Neah*, which the Country people tell us, grow at the End of a little Ruſh, and drop off, and are to be found only on *Mayday Eve*, and good for God knows what: They look like the Germinations of ſome of your ſalts, but in the Fire ſhew no ſigns thereof by Crackling: They are Electrical and Angular, and being pounded, the Powder is white.

LIX. I ſend

The Icy Mountain Gletſcher, By M. Muraltus, n. 49. p. 932. By . . . to Mr Juſtel, n. 100. p. 982.

LIX. 1. The higheſt *Icy Mountains* of *Helvetia*, about *Valeſia* and *Auguſta*, in the Canton of *Bern*, about *Taminium* and *Tavetſch*, of the *Rhetians*, are always ſeen covered with Snow. The Snow melted by the Heat of the Summer, other Snow being faln within a little while after, is hardned into Ice, which by little and little, in a long Tract of Time depurating it ſelf, turns into a ſtone, not yielding in Hardneſs and Clearneſs to Cryſtal. Such ſtones cloſely joined and compacted together, compoſe a whole Mountain, and that a very firm one; tho' in Summer time the Country People have obſerved it to burſt aſunder with great Cracking, Thunder like. Such Cracks and Openings being by the Wind covered with *Snow*, are the Death of thoſe that paſs over them.

At the Foot of theſe Mountains, are with great Labour digg'd out Cryſtals, which are fond among other Foſſiles, of two ſorts and Colours, ſome of them are darkiſh and troubled, which by ſome are call'd the *Cryſtal Ore*, to be plenteouſly found in the Aſcent of Mount *Gotthard*; others tranſparent, very pure, and as clear as *Venice Glaſs*, ſexangular both great and ſmall; as in the Mountains about *Valeſia*, and the Town called *Urſelen*, at the Foot of the Hill *Sthelenin*, they are digg'd out, and ſold at a good Rate, one particularly for 80 *l.* ſterl.

2. This *Icy* Mountain call'd the *Gletſcher*, is very high, and extends it ſelf every year more and more over the neighbouring Meadows, by Increments that make a great Noiſe and Cracking. There are great Holes and Caverns which are made when the *Ice* burſts; which happens at all Times, but eſpecially in the *Dog-days*. Very little of the ſurface melts in the Summer, and all freezeth again in the Night. When the Sun ſhineth, there is ſeen ſuch a Variety of Colours, as in a Priſm.

At the Foot of the Mountain, a Rivulet iſſues forth from under the *Ice*, which is pretty deep, and extremely cold.

There is ſuch another Mountain near *Geneva*, and upon the *Alps*. A certain *Capuchin* told me, he had been upon the higheſt of theſe Mountains, with a Trader in Chryſtal, who having driven his Hammer in one of theſe Rocks, and found it hollow and reſonant, made a Hole into it, and thence drew forth a Subſtance like Talk; which to him was a Sign there was Cryſtal. After which, he made a great Hole with Gunpowder, and found Rock Cryſtal in it.

The Formation of Chryſtals, by P. Franciſco Lana, n. 83. p. 4068.

LX. Being in the *Val Sabbia*, at a Place call'd *Le Mezzane*, where I knew that Cryſtals are generated, I obſerv'd in a ſpacious round of a *Meadow* ſeated on a Hillock, ſome narrow places bare of all Herbs, in which alone, and no where elſe thereabout, Cryſtals are produc'd being all ſexangular, both points of them terminating in a Pyramidal Figure, ſexangular likewiſe.

I was told, that they were produc'd from the *Dews*, becauſe (forſooth) being gathered over Night, the next Morning there would be found others at ſuch a time only, when it was a ſerene and dewy sky. But when I had examin'd that in the neighbourhood of that Hill, there was no Mark at all of any Mines, I did conclude that it might be a plenty of nitrous ſteams, which

might

might withal hinder Vegetation in thoſe Places, and coagulate the Dew falling thereon; for *Nitre* is not only the natural Coagulum of Water, as is manifeſt in artificial *Glaciations*, but alſo it ever retains the aboveſaid *ſexangular* Figure, altogether like that of theſe Cryſtals. Which may alſo be the very Cauſe of the *ſexangular* Figure in Snow; this being nothing elſe but Water concreted by its natural *Coagulum*, which is a nitrous Exhalation. And to make it yet more manifeſt, that theſe are indeed Expirations of *Nitre*, I digg'd up ſome of the Earth, and drew a ſalt from it, which had both the Taſte and Figure of *Nitre*; tho' ſome grains of it were of a ſquare, others of a Pyramidal Figure. And ſince theſe Cryſtals are only found in thoſe narrow places, we may very probably infer, that from thence are raiſed the Exhalations, which do concrete the Dew; after ſuch a manner as the Vapour or Exhalation of *Lead* coagulates *Quickſilver*.

An old Figured *Iris*, by Dr. Liſter, n. 110. p. 222.

LXI. I have not obſerved any Rock, or ſort of Stone, whether metalline or more vulgar, which hath not its different ſort of Sparr both for Colour and Figure, which is very common in our blew Lime-ſtone Rocks in *Yorkſhire*, out of which Plenty of Lead-Ore is got. They are moſtly of a black Water, like the black Flint in *Chalk Hills*, but there are of them, which have a purpliſh or *Amethyſtine* Colour, and ſome there are as clear as Cryſtal. They adhere to the ſeams of the Rock, be it betwixt Bed and Bed, or wherever there are croſs and oblique Veins thro' the very ſubſtance of the Bed. The ſmaller the Veins, the leſs the *Iris*. You will find of them as ſmall as Wheat Corns, and others an hundred times bigger. They ſhoot from both ſides the Steam, and mutually receive one the other.

They are figured thus, *viz.* a Column of 6 plains, very unequal as to the Breadth: the end adhering to the Rock is always rugged, as a thing broken off, the other end of the Column conſiſts of three quinquangular Plains, very little raiſed in the middle: Theſe Plains too are very unequal. Let them hug one another, and be any ways ſtreightned and compreſſed in their ſhooting; yet the Number of Plains mentioned, both of the Column and Top is moſt certain. The Places where infinite of them may be had, are *Rainſborough Scar* upon the *Ribble*, alſo in a ſtone Quarry, near *Eſhton Tarne* in *Craven*.

Tranſparent Pebbles, by Dr. *Liſter*, n. 221. p. 778.

LXII. Theſe *tranſparent ſtones* are of a conſtant ſhape, and in ſome ancient Leaſes of royal Mines, they are called *Rough* or *mineral Pearl*, being reſplendent and bright, and figured like a drop of Water. Some of them are exactly ſpherical, others like a half Globe, others like a half Oval, with an Edge raiſed on the Top. It was not without reaſon that they were eſteem'd by the ancients; For their *natural Poliſh* is not to be *counterfeited*, but very eaſie to be diſtinguiſht with a Microſcope, from the *artificial Poliſh* of *Glaſs* and *Chryſtals*. Now *Gold*, *Silver*, *Diamonds*, *Pearl*, are for no other reaſon eſtimable, but becauſe they have certain indelible Characters, which all the ſubtilty and wit of Man hath not yet been able to counterfeit, notwithſtanding many pretences thereunto; as *Gold*, for Example, that it will endure the drowning in *Antimony*; *Silver*, that it abides the Teſt of Lead; *Diamonds*, for that of themſelves, even without a Foil, they caſt a Luſtre; *Pearl* is valued becauſe of its Figures, and peculiar Brightneſs not to be imitated.

Theſe Stones are of the *Pebble kind*, that is, not to be calcined by ſimple Fire, whereas moſt other figured Stones are calcinable with a very eaſy Fire. They are very hard and ſolid, and do not conſiſt within of *Laminæ*, or Flakes, but break every way with great Difficulty, and naturally throughout ſmooth.

Their Figure comes neareſt to that of the *Ombriæ*, and many of them are very *Ombriæ* in ſhape. Other tranſparent *Ombriæ* I have ſeen, which yet are either very *Flints*, or of a *flaky* and ſoft Contexture, of the Nature of *Selenites*; and ſuch are to be found about *Filo-briggs*, a noted Set of Rocks near *Scarborough*.

As theſe Stones are of a very different Nature and Texture from all other *Ombriæ*, I ever yet ſaw, and having no *Veſtigia* of any *Spinæ* in any part of them, I may reaſonably enough conclude them to be Stones of their own kind.

I am not adverſe to think, after ſo manifeſt and conſiderable Diſcoveries as *Auguſtino Scilla* hath made in *Sicily*, that moſt of the *Ombriæ* have been *Echini*, and yet ſome of the Prickled, which Naturaliſts have hitherto call'd *Lapides Judaici*, may have belonged to ſome of thoſe *Ombriæ*. But there are only 2 or 3 *Echini*, yet diſcovered, either in ours, or the *Mediterranean Sea*; Whereas of the *Ombriæ* of *Europe*, beſides theſe preſent *Anomalous* Stones, there are at leaſt 20 *Species* figur'd and deſcrib'd by *Aldrovandus Auguſtino Scilla*, Dr. *Plot*, &c. and in vaſt Quantities in moſt Counties of *England*: And I doubt not many more Species will yet be found out. All which are to be accounted for, as to the natural Places, in what Seas they are to be found at this Day. And if not in the *European*, as I think they will not, how and whence they came hither into this Iſland in ſuch Plenty.

LXIII. 1. Among the excellent *Diamonds* brought from the *Eaſt-Indies* by *M. Tavernier*, there is one weighing $112\frac{3}{16}$ *Carats*, of a very fine Violet Colour, and two of a Roſe pale Colour; all three of an *Adamantine Hardneſs*, and upon that Account eſteemed *Diamonds*.

Diamonds, *B*. . . . n. 101. p. 26.

2. The Parts of the World known to contain *Diamonds*, are the Iſland *Borneo*, and the Continent of *India extra & intra Gangem*: *Pegu* is likewiſe reported to have ſeveral, but the King contents himſelf with his Mines of *Rubies*, *Sapphires*, *Topaſſes*, *Emeralds*, *Gold*, *Silver*, *Braſs*, *Tin* and *Lead*.

By the Earl Marſhal of England, n. 136. p. 909.

The *Diamond Mines* on the Coaſt of *Coromandel*, (of which I have viſited ſeveral) are generally adjacent to rocky Hills, or Mountains, whereof begins a great Ledge or Range, near Cape *Comorin*, extending in breadth about 50 *Engliſh Miles*, ſome conjoining others ſcattered; and running thence in Length quite through *Bengala*. In, among, and near theſe Hills, in ſeveral places, are known to be (as it is believed moſt of them have) Mines.

The Kingdoms of *Golconda* and *Viſiapore* contain in them ſcope enough of Ground, known to have *Mines*, ſufficient to furniſh all the World plentifully with Diamonds, but their *Kings* permit digging only in ſome Places appointed, leſt, as it is imagined, they ſhould become too common; and withal for fear of tempting the threatning Greatneſs of *Aurenge Zebe*, forbidding alſo thoſe Places that afford the largeſt Stones, or elſe keeping Workmen in them for their own private uſes.

1. In the Kingdom of *Golconda* (as near as I can gather from the beſt acquainted) are 23 Mines now employed, or that have been ſo lately.

Quolure was the firſt *Mine* made uſe of in this Kingdom. The Earth is ſomewhat yellowiſh, not unlike the Colour of our Gravel dryed; but wheter in ſome places where it abounds with ſmooth *Pebbles* much like thoſe that come out of ſome of our *Gravel Pits* in *England*. They uſe to find great quantities in the vein, if it may properly be ſo call'd, the *Diamonds* not lying in continued Cluſters, as ſome imagine, but frequently ſo very ſcattering, that ſometimes in the ſpace of ¼ of an Acre of Ground, digg'd between two or three Fathoms deep, there hath been nothing found; eſpecially in the Mines that afford great Stones, lying near the Superficies of the Earth, and about three Fathoms deep. The *Diamonds* found in theſe *Mines* are generally well ſhaped, many of them pointed, and of a good lively white Water; but it alſo produces ſome yellow ones, ſome brown, and of other Colours. They are of ordinary Sizes, from about 6 in a *Mangelin*, * (of which they find but few) to 5 or 6 *Mangelins*, each; ſome of 10, 15, 20, they find but rarely. They have frequently a bright and tranſparent Skin inclining to a *Greeniſh* Colour, tho' the Heart of the Stone be purely white; but the Veins of theſe Mines are almoſt worn out.

* a Mangelin is 4 Grain. in weight, *ſaith* Linſchotten.

2. The Mines of *Codawillikul*, *Malabar* and *Buttepallem*, conſiſt of a rediſh Earth inclining to an Orange Colour, (with which it ſtains the Cloaths of the Labourers that work in it;) they dig about 4 Fathom deep. They afford Stones generally of an excellent Water and cryſtalline Skin: ſmaller ſizes than thoſe of *Quolure*, *Ramiah*, *Gurem*, and *Muttampelle*, have a yellowiſh Earth like *Quolure*, their Stones like thoſe of the two former Mines, but mixt with many of blew Water. Theſe 5 Mines being under the ſame Government with *Melwillee*, where the Governor reſides; he has lately forbid their uſe, and commanded all to repair to his Reſidence.

Currure (the moſt famous of them all and moſt ancient) has been under ſubjection of the King of *Golconda*; but about 25 Years ago was taken, with the Country of *Karnaticum*, from the *Hundue-Rajaes*, by the *Nabob Meer Jumla*. In it have been found *Diamonds* of a *Seize weight*, which is about 9 *Ounces Troy* or 81½ *Pago*'s Weight. It is only employed by the King for his own private uſe. The *Diamonds* that are found in it, are very well ſpred, large Stones (it yields few or none ſmall) they have generally a bright skin, which inclines to a pale greeniſh Colour, but within are purely white. The Soil is reddiſh, as many of the others.

About 60 or 70 Years ago, a *Portugueze*, went thither from *Goa*, and having ſpent in Mining all that he had, even to what wearing Cloaths he could ſpare, while the Miners were at work for the laſt Days Expence, he had prepared a Cup of Poyſon, reſolving if that Night he found nothing, to drink his laſt with the Concluſion of his Money; but in the Evening the Workmen, brought him a very fair ſpread Stone, of 20 *Pago*'s weight, in Commemoration whereof he cauſed a great Stone to be erected in the Place, with an Inſcription engraven on it, in the *Hundues*, or *Tellinga Tongue*, to the following Effect, which remains to be ſeen till this Day.

Your Wife and Children ſell, ſell what you have,
Spare not your Cloaths, nay, make your ſelf a Slave.
But Money get; then to Currure *make haſte;*
There ſearch the Mines, a Prize you'll find at laſt.

Not far from *Currure* are the Mines of *Lattawaar* and *Ganjeconta*, which are in the ſame Soil as *Currure*, and afford ſtones not unlike: But *Lattawaar* hath many repreſenting the great end of a Razor Blade, thin on one ſide, and thick on the other, very white and of an excellent Water; but the beſt of the Mine is worn out, and *Ganjeconta* employed only to the King's private Uſe.

Jonagerre, *Pirai*, *Dugulle*, *Purwillee* and *Anuntapelle*, conſiſting alſo of red Earth, are now employed and afford many large Stones; part of them of a greeniſh Water; but the moſt abſolute Mines are of *Wazzergerre*, and *Munnemurg*, (the other rather repreſenting Pits than Mines) for there they ſink thro' high Rocks, till they go ſo far below their Baſis, that they can go no further for Water, in ſome places 40 or 50 Fathom deep. The ſuperficies of the Rocks conſiſts of hard, firm white Stone, into which they cut a Pit, like a Well, of about 4 or 5, in ſome places 6 Foot deep, before they come to the Cruſt of a *mineral Stone*, like the *Mineral* of *Iron*; then they fill the Hole with Wood, and keep as hot a Fire as they can there for 2 or 3 Days, till they think it ſufficiently heated, then they pour in water till they have quench'd it, which alſo flakes and mollifies both *Stone* and *Mineral*; both being cold, they dig again, take out all the crumbled Stuff, and dig up what they can beſides, before they heat it anew; the Cruſt ſeldom is thicker than 3 or 4 Foot, which ceaſing, they come to a Vein of Earth, that uſually runs under the Rock 2 or 3 Furlong, ſometimes much further, This they dig all out and ſearch, and if their firſt Attempt prove ſucceſsfull, they go to work again, digging again after the ſame manner, as deep as they can, till they come to Water, for the drawing whereof, wanting the help of Engines, known in *Europe*, they can go no deeper, altho' the Vein lie lower; all Lumps of the Mineral they break in pieces, and frequently find Diamonds incloſed in them. The Earth is red. Many large Stones are found here, the ſmalleſt about 6 in a *Mangelin*. They are mixt Waters, but the greateſt part good, only of ill favoured ſhapes, many cragged pieces of Stones, ſome as if they had been parts of very great ones, others with pieces broken off them ; yet I never heard of any that found two ſeem i lows, altho' they do thoſe that look as if they had been newly broken.

In *Langumboot* they dig as they do at *Wazzergerre* and *Munnemurg*, the Rock is not altogether ſo ſolid, but the Earth and Stones it produces much alike.

Wootoor lies near *Currure*, and affords Stones of a like Magnitude, Shape and Waters; 'tis employed only to the King's uſe: And ſingular, in that it's Diamonds are found in black Earth.

Muddemurg far exceeds all the reſt for *Diamonds* of a delicate ſhape, water, and bright tranſparent Skin ; yet it has ſtore of Veiny ones, but thoſe likewiſe of ſo curious ſhape and water, that it is difficult to diſcover them from the good, eſpecially the ſmall ones. It produces *Stones* of divers Magnitudes, from 10 and 12 in a *Mangelin*, to 6 or 7 *Mangelins* each ; and beſides, ſome great ones. The Earth is red : but it is ſeated in the Woods, and the Water ſo bad, that to all (except the People bred there) it preſently occaſions Fevers, and deſtroys abundance, inſomuch that moſt of the *Adventurers* have forſaken it ; notwithſtanding which, it had been more profitable than any of the reſt, the Vein frequently lying near the ſuperficies of the Earth, ſeldom running deep, and is better furniſhed than any one yet diſcovered. The River *Kiſhma*, of excellent Waters, is but 9 Miles diſtant, but the Miners or Merchants will not be at the Charges of fetching their Water from thence. Divers are of the opinion, that beſides the water, the Town lying in a Bottom, environed with Hills, and a Moraſs adjoyning, the Air may be infected, and contribute to its Unhealthfulneſs.

Mellwillee, or the *New Mine*, ſo called, becauſe it was but lately found out, or at leaſt permitted to be made uſe of, in the Year 1670 ; it had then a year employed the Miners, but it was forbidden, and lay unoccupied till 1673, when Complaints being made at *Quollur*, that the Vein was worn out, the King again licenſed its ſettlement. The Earth they mine in is very red, and many of the *Stones* found there have of it ſticking to them, as if it had clung there while they were of a ſoft glutinous ſubſtance, and had not attained their Hardneſs, maintaining its Colour on its Skin (ſeeming to be roughned with it) that it cannot be fetch'd out by grinding on a *rough Stone* with *Sand*, which they make uſe of to clean them. The *Stones* are generally well ſhaped, their ſize from 5 or 6 in a *Mangelin* to thoſe of 14 or 15 each, and of ſome bigger ; but greateſt Quantities of the middle ſorts : Moſt of them have a thick dull Skin, incline to a yellowiſh Water, not altogether ſo ſtrong and lively as of the other Mines, very few of them of a cryſtalline Water and Skin. They are reported to be apt to flaw in ſplitting, which occaſions thoſe People to eſteem them ſomething ſofter than the Product of many of the other *Mines* ; ſeveral that flatter by their ſeeming *Whiteneſs*, when rough, diſcover their Deceitfulneſs, having paſs'd the Mill, and too often a yellowiſh Tincture, to the diſappointment and loſs of them that have cut them ; but what they want in Goodneſs, is in part ſupplied by the Plenty they find, which, together with their Properties, make them the cheaper.

2. *Viſiapore* is known to contain Mines encloſing *Stones* as large and good as thoſe of *Golcanda*, but the King makes uſe but of the meaneſt. There are 15 Mines employed in this Kingdom.

In *Ramulconeta-mines*, in red Earth, about 15 or 16 Foot deep, they ſeldom find a *Diamond* of a *Mangelin* weight, but ſmall, to 20 or 30 in a *Mangelin*. They are generally of an excellent *cryſtalline Water*, have a bright clear Skin, inclining frequently to a pale greeniſh Colour, are well ſhaped, but few of them pointed ones. There are alſo found amongſt them ſeveral broken pieces of *Diamonds*, by the Country People called *Shemboes*.

The Mines at *Banugunnapelle*, *Pendekull*, and *Moodawarum* : at *Cummerville*, *Paulkul* and *Workul*, which are not far diſtant from *Ramulconeta*, afford Stones much alike, and in the ſame kind of Earth, but in the three laſt are very ſmall ones, even to 100 in a *Mangelin*.

Lungepoleur Mines are of *yellowiſh Earth*, like thoſe of *Quolure*, its *Diamonds* are generally well ſhaped, globular, few, pointed, a very good cryſtalline Water, and bright Skins, many of them have a thick dark graſs-green Skin, ſome ſpotted alſo with black, that they ſeem all foul, yet are not ſo, but within purely white and clean. Their Sizes are from 2 or 3 *Mangellins* downwards, but few very ſmall. *Pootloor-mines* are of a reddiſh Earth, but afford Stones much like thoſe of *Lungepoleur*, only ſmaller; under a *Mangelin*; the general ſizes are of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{20}$, of a *Mangelin*.

Punchelingul, *Shingaxrampent*, and *Tondarpaar*, are alſo of red Earth, their Diamonds not unlike thoſe of *Quolure*, only rarely or never any large ones are found there.

Gundepellee hath the ſame Earth with the former, and produces Stones of equal Magnitude; but frequently of a pure *cryſtalline Water*, wherin they exceed the former.

Donee, and *Gazerpellee*, dig both in red Earth likewiſe, and afford Stones alike, the greateſt part whereof are of good ſhapes and Waters. They have alſo many *Shemboes*, and ſome of bad Waters, ſome brown, which theſe People call ſoft, or *weak-water'd*, being eſteemed of a ſofter and weaker Body than others, by reaſon they have not ſo much Life when cut, and are ſubject to flaw in ſplitting, and on the Mill. Their general Product is in *ſtones* of middle ſizes: But *Gazerpellee* has, beſides many large ones, and is the only Mine noted in the Kingdom of *Viſiapore*.

The *Diamonds* (in all the *Mines*) are ſo ſcattered and diſperſed in the *Earth*, and lie ſo thin, that in the moſt plentiful Mines it's rare to find one in digging, or till they have prepared the ſtuff, and do ſearch purpoſely for them. They are alſo frequently incloſed in *clods*; and ſome of thoſe of *Melwille* have the Earth ſo fixt about them, that till they grind them on a rough Stone with Sand, they cannot move it ſufficiently, to diſcover they are tranſparent, or were it not for their ſhapes, to know them from other *Stones*. Sometimes the unskilful Labourers, to try what they have found, lay them on a great *Stone*, and ſtriking on them with another, to their coſtly Experience, diſcover they had broken a Diamond.

Near the Place where they dig, they make a *Ciſtern* about 2 Foot high, and 6 Foot over, with a ſmall Vent in one of the ſides about 2 Inches from the bottom, by which it empties it ſelf into a little Pit made in the Earth to receive ſmall ſtones, if by chance any ſhould run thro'. The Vent being ſtopped, they fill the Ciſtern they have made with Water, ſoaking therein as much of the Earth they dig out of the Mines, as it can conveniently receive at a time, breaking the Clods, picking out the greateſt Stones, and ſtirring it with ſhovels till the Water is all muddy, the gravelly ſtuff falling to the bottom; then they open the Vent, letting out the foul water, and ſupplying it with clean, till all the earthy ſubſtance be waſhed away, and none but a Gravelly remains at the bottom. Thus they continne waſhing till about 10 of the Clock before Noon, when they take the gravelly Stuff they have waſhed, and ſpread it on a Place made plain and ſmooth like a Bowling Alley, for the purpoſe, near the Ciſtern, which being ſoon dried by the heat of the Sun at that time of the Day, they very curiouſly look it over, that the ſmalleſt bit of a Stone can hardly eſcape them. If they find a large Stone, they deliver it not till they have done work, and then very privately, leaſt it ſhould come to the Knowledge of the Governour of the Place, and he require a ſhare, which in the Kingdom of *Golconda* is uſually practiſed, without reſpect to any Agreement made with them.

The Miners, thoſe that employ them, and the Merchants that buy the *Stones* of them are generally *Ethnicks*; not a *Muſleman*, that ever I heard of, followed the Employment. Theſe Labourers and their Employers are *Tellinga's*, commonly Natives of or near the Place. The Merchants are the *Banians* of *Guzzarat*, who, for ſome Generations, have forſaken their own Country to take up the Trade, in which they have had ſuch ſucceſs, that 'tis now ſolely engroſſed by them, who correſponding with their Countrymen in *Surrat*, *Goa*, *Golconda*, *Viſiapore*, *Agra* and *Dillee*, and other Places in *India*, furniſh them all with Diamonds.

The Governours of the Mines are alſo Idolaters. In the King of *Golconda's* Dominions, a *Feulinga Bramme* rents moſt of them, whoſe Agreement with the Adventurer is, that all the Stones they find under a * *Pagoda* Weight, are to be their own, all of that Weight and above it, to be his for the King's uſe. Both Merchant and Miner go generally naked, only a poor Clout about their middle, and a Shaſh on their Heads; they dare not wear a Coat, leſt the Governor ſay they have thriven much, are rich, and ſo enlarge his Demands on them. The wiſeſt, when they find a great Stone, conceal it till they have an Opportunity, and then with Wife and Children run all away into the *Viſiapore* Country, where they are ſecure and well uſed, by reaſon whereof their Mines are much more populous, and better employed than thoſe of *Golconda*.

It is obſervable, that notwithſtanding of the Agreement with the *Adventurers* of the *Mines* that all *Stones* above a certain weight ſhall be for the King's uſe; yet in the *Metropolis* of either Kingdom, as the Cities of *Golconda* and *Viſiapore* are, there is no ſeizure, all Stones are free; and the late deceaſed King, *Abdub Cutopſhaw* of the former, and *Edelſhaw* of the latter, would not

* *A* Pagoda weight is 9 Mangelins.

not only give very great Prices for large Stones, but richly veſt, and Preſent the Merchant that ſold them with Horſes, or ſomething elſe of Value, thereby encouraging others to bring the like.

The Production of Amber; By Mr. John Schefferus. n. 19. p. 343.

LXIV. 1. Mr. *John Schefferus* conceives Amber to be a kind of Foſſil Pitch, whoſe Veins lie at the bottom of the Sea; believing that it is hardened in Tract of Time, and by the motion of the Sea caſt on Shore. He adds, that hitherto, it hath been believed, not to be found but in *Boruſſia*: But he aſſures that it is alſo found in *Sweden*, on the Shores of the Iſle of *Biorkoo*, in the Lake *Melero*, whoſe Water is ſweet. Of this he ſaith, he hath a fine piece by him, two Inches large and thick, preſented him by one that himſelf with his own Hands had gathered it and ſeveral other Pieces, on the Shore of the ſaid Iſland; affirming withal from the Mouth of a Shepherd of that place, that it is thrown out by a ſtrong Wind, bearing upon the Shore.

By Mr. Hevelius. Ib. p. 346.

2. I am almoſt of the ſame Mind with M. *Schefferus*, that *Amber* is a kind of *Foſſil Pitch*, or *Bitumen*, ſeeing it is not only found on the Shore of the *Boruſſian* Sea, but alſo digged up in Subterraneous places, ſome *German* Miles diſtant from the Sea; and that not only in Sandy, but alſo in other Hills of firmer Earth; of which I have ſeen my ſelf pretty big Pieces.

An Account of Amber; *By* Mr. Phil Jac. Hartman, n. 248. p. 5.

3 Succini Antiquiſſimis Temporibus cognita Virtus celebre ipſi, pluribus ante *Chriſtum* natum Seculis, apud ſcriptores Græcos peperit Nomen. Poſtquam *Romanis* Admirationi eſſe cœpit, & his Auctoribus Gemma reddita eſt Memorabilis: Præſertim cum Neronis Mores in Luxum Succino abuti docerent. Quantacunque vero Succinorum Vetuſto Ævo fuerit Æſtimatio, Terræ tamen, in quibus generantur, incognitæ manſere; inde tot ſententiarum Divortia; his in *Africa*, iſtis in *Aſia*, aliis in *Europa*, Theſaurum reconditum memorantibus. Inter *Europæas* Ditiones, *Italiæ*, & in eadem *Eridani* vicinique Maris *Adriatici* ex ſuccineis Divitiis præcipua Laus fuit; quam tamen fida magis Hiſtoria, *Romanis* latè per *Germaniam* Victricia Arma circumferentibus, Maris *Germanici* ac *Baltici* Inſulis vendicat, *Hiſpania* & *Britannia* in partem aliquam Gloriæ admiſſis.

Verum ut Veteribus tot Regiones *Succiniferas* allegantibus ignoſci poſſet, neſcio an Proximo aut huic Noſtro Ævo Venia ſit danda, etiamnum ex *Africa* & *Aſia* quin ex novo detecto Orbe, nativum ſuccinum afferenti, vulgato inſuper *Orientalium Succinorum* Nomine. Quod enim cum Pace tantorum Virorum dixero, plerique Auctorum ſunt inteſtabiles, Rumoribus plus juſto Tribuentes: Oculatos Teſtes, fallere & falli neſcios, vix produxeris. Per multos quidem qui in *Orientalibus* Partibus commorati diutius, Rerumque Phyſicarum fuerint gnari, ipſemet atque Amici, coram & Literis, percontati ſumus, neque incidimus in quempiam, qui certi quidpiam cum Fiducia ediſſerere noſſet; majorque pars, quicquid de *Orientali Succino* Fama ſparſit, aut ſcriptis prodidit, Incertitudinis aut Falſitatis condemnavit. Quin Nomen *Ambari* ſive *Ambræ*, quod *Succino* cum Pretioſiſſimo & Fragantiſſimo *Orientali Bitumine* jam diu apud plurimas Nationes Commune eſſe cœpit, non paucos in Errorem induxit: *Succinum* enim crediderunt, quum *Ambram* in *Africa*, *Aſia*, *Americave*, Partibus naſci acceperant. Si non alius

Error *Succinum Orientale* progenuit, Reſina *Copal, Succinum* mentiri aptiſſima, hoc Nomine ab Officinis *Pharmaceuticis* adoptata.

Nec in *Europa* memoratis omnibus Provinciis, ſuccinum Generatur; Inanibus Auctorum de *Eridano*, *Mari Adriatico*, aliiſque *Italiæ* locis *Succiniferis*, Commentis. Nec de *Hiſpano*, *Britannico*, *Pannonico Succino* graviora aut certiora proſtant Documenta *Gagates Succini Nigri* Appellatione ſcriptoribus impoſuiſſe videtur. De *Polonicis*, *Sileſiacis*, *Bohemicis Succinis* effoſſis, quamvis Raros in Patriis Annalibus præcones nacta ſint, indubitata Experientia conſtat. *Germanici* ſuccini Crebrior & Evidentior eſt Memoria. In Litoribus Maris ad Inſulas *Belgicas*, ad *Holſatiam Jutiam*, in Ripis etiam Fluviorum, Lectum; quin ex Interioribus Terræ viſceribus erutum, graviſſimi Auctores conſignarunt. *Saxonia*, *Miſnia*, *Iſlebia*, *Suevia*, ex Gremio Matris Telluris ſe hunc Fœtum ſuſcepiſſe, aliquoties atteſtantur: *Hallenſeſque* Carbonariæ Fodinæ, ſereniſſimi *Frederici III.* Auſpiciis non ita pridem detectæ, ſuccineas viliores Glebas plus via ſimplici oſtenderunt; Fidem faciente D. *Krug.* S. Electoris *Brandenb.* Archiatrorum Comite & Conſiliario, Rerumque Metallicarum Directore Gnariſſimo atque Meritiſſimo. Nec Ignobiliora Teſtimoria inclyta Marchia perhibet: Superiori ſeculo Jodochus Wilichius, prope Neomandram, novam Collam dictam, Francofurto ad Oderam Tria Milliaria, circiter Diſtantem, in Lacus ingentis Ripa ſuccinum Falernum repertum; noſtra Ætate in Ripa Viadri prope Cuſtrinum juxta Pagum *Schaumberg* inventum, Cl. D. *Becmannus*; eque Foſſa Inſulæ Pottamenſis regnante Magno *Friderico Wilhelmo* eductum, Cl. D. *Elſholtius*, memorarunt. Major autem Succinorum eſt proventus in locis Mari Baltico vicinis. Suecia, vel ex Lacus Dulcis Meleri Ripa Ejectum, ſæpius legit, aut Effoſſum ſuſtulit; *Dania* ex Foſſà Hafnienſi inſignia Succina vidit, & admirata eſt, atque ex Collibus Selandiæ ſuæ Mediterraneis non contemnenda Magnitudine ac Multitudine prodiiſſe, uniuſque Colliculi Foſſionem quinquaginta Libras erogaſſe, Vomereque ex Agris extracta, meminit; Teſteſque Cl. *Borrichii* adſunt Literæ, Inſulas *Cimbriam Holſatiamque* allambentes [*Formoe Mandoe, Rom.*] ad Littora ſua in Oceano pariter Copioſum Succinum expiſcari. Liberalius tamen longe in Samogitiæ, Curoniæ & Livoniæ Contermina Mari Baltici Litora Succineæ Opes redundant; ut inter Algas Arenaſque abſconditæ à Ruſticis confertim deprehendantur. Inter Arandum quoque, & inter Fodiendum, in Maritimis Jugeribus ſeſe ultro, ſine gravioris Laboris impendio, offerunt, Vili Pretio ab Electrotoreutis ibi locorum quondam coempta.

Verum nulla Maritimarum Provinciarum, æque Opima ſpolia ex Mari Baltico legit, nulla ex ſinu Telluris æque numeroſam Prolem Succineam ſuſcipit, ac Pruſſia; ut Electrides Antiquorum nullibi rectius collocaveris. Allata ſunt mihi ex Sambia, ex Natangia, ex Hockerlandia, ex Pomerania fortuito inventa ſuccina; & prope Oppida Hollandiam, Liebſtadium, detecta; quæque ex Electoralis Lithuaniæ Agris effoſſà, Varmienſia quoque & Elbingenſia poſſideo. Olim Vir Conſularis, mihi Amiciſſimus, annotarat, in Sylva quadam *Kerbſwald Elbingenſis* Ditionis An 1641. intra modicum Temporis ſpatium, Septingentas Libras fodiendo ex Terra erutas; fruſtumque Inſigne Amicus nuperrime dono dedit, cujus idem Natale fuerat ſolum. Et in Ripis Lacus Recentis ac Curonienſis Fluviorumque Pregelæ, Viſtulæ, Elmæ,

lecta

jecta adeptus ſum. Adeoque nullus dubito, totum Pruſſiæ Fundum Succineum affirmare, præſertim cum ſcaturigo de repente An. 1666. circa Oppidum *Bartenſtein* exundans, tantum vim Succinorum egeſſerit, ut Fiſci Reditus augeret; quæ a Terræ viſceribus avulſa, nec Mare vidiſſe unquam, certa eſt Fides.

Poſt *Pruſſiam*, *Pomerania Succinifera* nominari meretur, illo potiſſimum Oræ Maritimæ Tractu, qui per Litora Electoralium hinc & Olivenſium ac Gedanenſium Ditionum ad Neriam Recentem excurrit. Multum Succini cum Decumanis Fluctibus ad hanc Oram advolvitur, iiſdem ſignis proventum manifeſtantibus Electrotoreutarum Gedanenſium Quæſtu non ſpernendo, quia ſenatu juſto præcio, quæcunque ad Neriam appellunt, redimerunt. Ad Inſulam Rugiam uſque Maris Baltici effuſa eſt Liberalitas, ſiquidem & hæc Succineis Glebis potitur; juxta Hiddenſee & Lectas & Hauſtas percepi. Nec Mediterranea Pomeraniæ Succinorum ſunt vacua, quippe quod pariter bona Fortuna in eadem Ruricolæ aliud agentes incidant ſæpius; *Curoniaque* & *Samogitia* inter *Succiniferas* Palmam *Pomerania* dubiam reddit.

Pruſſiam quaquaverſum Succiniferam prædicavi, ut tamen præcipue Litoris Sudavici amore Succina detineantur; ſitum eſt Litus in iſta parte, quæ Sambia vocatur, a novo Tranſitu (Neve Tiff) ad Tabernam (Vrantz Vrug,) decem Milliarium ſpatio. Regia hæc Succinorum ſedes, ſeptem Receſſibus vulgato Angulorum vocabulo, Antiquitus diſtinguitur: Krecke, Nodums vel Nodems, Laſnicken, Kuckſe, ſive Kuyck Palmenick, Nempe, Thierskeim; Noſtra Ætate non Nempe, ſed Kraydepellen, ſive Crapellen inter Palmenig & Subenig, tum Bruſter magis quam Dirſchkeim, & præter hos alii accenſentur. Litus omne altis Montibus præcingitur, Mari Vadoſo; a Primo Ingreſſu Trium Quatuorve, mox Triginta aut Quadraginta Orygarum, poſtquam progreſſus fueris Profunditate minori, pergendo longius rurſus Altiſſima; ut Brevia ſive Syrtes intelligas, quæ Litus Sudavicum, hujuſque Receſſum Bruſteram adprime Naufragiis infamant. Prærupta & ardua Receſſum Juga, quædam lentius attolluntur, verſus *Pillaviam* in Planitiem deſinunt. Solum minus firmum; alicubi latentium Aquarum Commeata fallax, in tantum ut quaſi Voragine Equi & Homines abſorpti memorentur; maximam partem ſabulo tegitur, aliquot Areolæ Herbis inveſtiuntur, *Petaſite*, *Eryngio*, *Lappa*; raris Arbuſtis aut ſenticetis, quæ tamen ad *Bruſteram* ſilveſcunt; eademque cum parte Montis aliquando ſubſidunt, Rupes nullæ nec ſaxa, præterquam ad Radices Montium: Aquæ ex ſummis jugis paſſim dimanant, quæ inferius Alveis collectæ Rivulos imitantur. Iſta Exteriori facie Litoris *Sudavici*, Interranea Mineralibus abundant: *Vitrioli* non una comparet ſpecies: Alibi Niveis ſtriis, Terra Nigra interjecta, ſtratum ſuper ſtratum alicubi Fuſum Vitrum, Ligneis Fibris hinc inde interlucentibus, præſentat; alibi Terræ Micantium Pulviſculorum inſtar eſt admixtum. Præter *Vitriolum* Corticoſa Terra, qua integri Colles exſurgunt, & Lignum quod Litoreos Montes longo tractu medios dividit, ſunt conſpicua; tum terra flaveſcent, quæ *Ochram* æmulatur, & Lutum Cœruleum, certis Intervallis per Litus expanſum. Ex Lapidibus memorabiles *dactyli fidei* (*Alpenſchoſs*) inter ſaxa & Arenas diſperſi, ſed & ex Montibus effodiuntur:

Saxa Mari vicina alia parte duriſſima, alia friabilia viſuntur: Petrefacta quoque Ligna Lapideſque *Alga Marina* Tenui Folia & veſiculari luxuriantes inveni: Mitto varios Luſus Naturæ in quos incidi. Præter vulgares Lapides, & *Adamantes*, & *Jaſpides* hoc Litus quandoque profert. Camporum Vicinorum ſterilitas ſumma; ſilvæ Raræ: Pineæ nullæ. Illud adjiciendum, quod *Phocarum* Greges apricantes, in Scopulis & Collibus vadoſi Maris colludentes, ſæpius ſe conſpiciendos præbeant.

Litus hoc quidem inter Arenarum Lapidumve acervos *Succina* monſtrat; ſed in his non Generari manifeſtum eſt: Multo minus ex Alga Marinâ natales accerſendi, licet huic involuta ad Litus propellantur. Et quum intra Viſcera Montium Litoreorum ubique reperiuntur, in *Vitrioli* interſtratis *Cryſtallis*; in Terræ Flavæ, in Sabuli, in Luti Cœrulei intertexto opere; non tamen in his omnibus prima eorum ſtatuenda Incunabula. In *Vitriolorum*, Terræ Flavæ & Sabuli partibus raro eventu *Succina* eaque Minuta & ignobilia deprehenduntur. Cœrulei Luti ductus nondum ita Experientia patuere, quod inacceſſi; quamvis Egregia & Numeroſa *Succina* fovere a Colonis tradantur; mihique diffracta Luti Gleba, Nativus Fœtus *Succineus* animadverſus, quem Tenui Cortice obductum, Colore Fulvo dilucidum, inter Cara Naturæ *Succinea* munuſcula Muſæum aſſervat.

Quum autem Corticoſa Terra, & præter hanc Lignum Litus *Sudavicum* diſcriminent, Lignum quod Montes interſecat *Succiniferum* eſſe, ut quod maxime, multorum Annorum Experientia firmat. Hujuſque Ductum Foſſores indagant & obſervant, nunquam irrito Succeſſu, quouſque inſtabile ſolum ipſorum operas progredi permittit: Terra Corticoſa *Succina* exigua complectitur: minuſque ſolida, & ingrati Coloris. Lignum autem minime ab Arboribus eſt Arceſſendum; ſiquidem tam vaſtos Truncos Arboreos, qui proſtrati plurimarum Orgyarum Longitudine & Latitudine Fibras ſuas extenderent, nuſquam Orbis vidit. Neque Arboreis Lignis ſimile eſt: quippe, quod nec Medullæ Intimæ nec Corticis Extimi, ullum præbet indicium; Ramorum quoque Divaricationibus ac Nodis, Foliorumque Germinibus, prorſus deſtituitur; neque Fibras mutat, ſed eaſdem quavis ſui parte retinet: mitto quod Compagem Ligneam referens non tamen orbiculatim concreviſſe cernitur, ſed planiori ſpecie.

Atque Curioſi jam diu Ligna *Subterranea* mirari deſierunt, poſtquam plures *Europæ* Ditiones iſtiuſmodi, e Terra eruta, ipſorum Cenſuræ ſubmiſerunt. Ducatus *Spoletani* ſive *Umbriæ* fodinarum Lignum elegantiſſimum undulatum, in quo & Artificum ingenia ſe exercere poterant, *Franciſcus Stellutus Lynceus* deſcripſit, inventore Duce & Principe *S Angeli Friderico Ceſio*; ejuſdem & P. *Kircherus* meminit. Aliud *Germaniæ* Foſſile Lignum, Solertia D *Pillingen* in *Miſnia* detexit, qui & Erudito Commentario Generationem illuſtravit. Tranſmiſſus mihi *Lunenbergenſis* Ditionis Subterraneus Fœtus Ligneus, *Pruſſico* Solidior & Ponderoſior. Lignum vero quale Litus *Sudavicum* profert, & alibi locorum, in *Pruſſia* Interiori, una cum *Succinis* erutum, ex compluri- um Amicorum Literis fide Digniſſimis reſcivi: Graveſque mihi Auctores *Bartholinus* & *Berrichius*, qui Cortices & Ligna ex Foſſis *Haſnienſibus* iiſdem, ex quibus *Succina*, non exigua Quantitate educta atteſtantur; felixque Capuræ in dicium in Litore *Neringæ* ex adnatantibus Fragmentis capitur.

Matricis autem hujus, Experientia Duce, iſta indagavi Initia ac Rudimenta. Colliculi in Litore *Sudavico* hinc inde, imprimis ad *Kraxtepellen*, procul Terra congeſta, ubi propius acceſſeris Cumuli Coacervatorum Corticum videntur: Superior pars, ſicubi a Sole exſiccata fuit Griſeis, his autem remotis, piceæ Nigredinis, magnis & levibus nitidiſque Cruſtis concretam offert Terram, quam ſi Cultro ſecueris, multorum molliſſimorum Corticum Compagem conſpicies; Ad Radicem iſtorum Colliculorum Uda Terra, Glutinoſo ac Tenaci Liquore cohærens, Manuum Digitorumque impreſſorum Veſtigia exacte refert, ſed ut & Tangentes denigret. Talem Corticoſam Pinguem Colliculorum Terram *Ligni Foſſilis Pruſſici* judico Primordium; Neque Lignum niſi Siccitate, & qualicumque Soliditate, qua magis compactum longiori Fibrarum Protenſione, continua cohæret, a Corticibus iſtis differt. Corticoſi enim Colliculi ab Uda Tenaci Terra naſcendi Originem ſortiuntur; Hanc poſtquam Maris Salſugo aliis *Subterraneis Salibus* admixta maceravit ac ſubegit, ſecedente Humore ſuperfluo, Aer aut Calor Solis exſiccat; Siccitate vero a ſe invicem ſecedunt partes, quarum Pinguedo exhalavit, aut intus conceſſit; aliæ quæ Glutine hoc abundant, mutuo, licet in Cruſtas compactæ, cohærent, Speciemque Ligni referunt ubi juſta Siccitas, qualicunque multarum Cruſtarum Cohæſioni Lignoſam Formam conciliavit. Bituminoſam vero Corticum & Ligni eſſe Naturam non ſolum Terreſtris Pinguedo, ſed & Examen ignis monſtrat; accenſa enim Fomitis inſtar Serpentum Ignem propagant Sulphurque Naribus afflant; & Deſtillationi expoſita, uti inferius tradituri ſumus, aliquot Oleoſas particulas, *Olei Petræ* ſimili Odore, dimittunt, præterquam quod Liquor Deſtillans *Succineum* Pingue quid exhalet. Poſt Bitumen Corticum & Ligni Generationem Salia Subterranea promovent; ab his enim Siccitas, & Cruſtarum Species deducenda intime enim Lignis & Corticibus adhærent, *Vitriolum* ſuperius diſſeruimus, quomodo Cortices undique ambiat, atque cum illis concreſcat. Aliorum Salium non ita manifeſta eſt Demonſtratio; Deprehendi tamen in Sicciſſimorum Lignorum Corticoſæ Compagis Interſtitiis, ſcintillantes ſalinas Stellulas & Fila ſplendentia, quæ *Vitriolum* minime referebant, inſipidæ enim prorſus, aut ſubdulces, leniſſime adſtringentes: Aqua affuſa eduxi illas ſtellulas, *Lixiviumque Aluminis* aut magis *Martis* ſubdulcem ſaporem prætulit, ut tamen *Vitriolica* Virtus extremum perciperetur, quæ inſpiſſato *Lixivio* evidentior, aliquo tamen Subdulcis *Aluminoſi* aut *Martialis* Saporis ſenſu. *Nitrnm* quoque ſub hoc Ligno latens olim detexi, Forti *Lixivio vitriolicis* particulis ſegregatis; quamvis ipſi *Vitriolo Pruſſico Nitrum* videatur admixtum: forte & ſtellulæ ac Fila ſalina per intimas Ligni Fibras diducta, *Nitroſæ* ſunt Naturæ. *Alumen* quoque in Cryſtallis *Vitrioli* latet, ſi non prorſus *Alumini* vindicandi, quos *SSS* componere aſſeruimus quique *Amiantho* aut *Alumini Plumoſo*, ſimiles conſpiciuntur; Acidulus enim horum ſapor, ad illum ſalis *Succini* volatilis proxime accedens.

Matrice cognita, quibus *Bituminis* & *Salis* Virtutibus ſit impregnata, facile eſt conjicere quomodo *Succineus* Fœtus *Pruſſicus* intra illam concipiatur. *Pruſſiæ* ſolum undiquaque *Bituminoſum* cogita; inſignes enim Glebæ *Bituminis* condenſati in abditis Terræ aut Luti aliquoties a Colonis caſu deprehenſæ; ipſemet aliquot *Librarum* Fruſtum non procul a *Regiomonto* ex Limo eductum conſpexi, quin *Olei* rivos ex Terra dimanaſſe, non vana Fama accepi. Ceſpites vero *Bituminoſi* ex pluribus Locis effodiuntur. *Bituminoſo* itaque Litoris *Sudavici* Solo Calor Subterraneus, quicunque iſte fuerit, *Bituminis* exhalationes per interranea diſperſas, undique conſociat, & in Guttas cogit, præprimis ex Corticoſa aut Lignoſa Matrice eaſdem congregat; quod dum agit, ſimul vicina *Salia* pervadit, ipſorumque Effluvia ſecum abducens *Bituminoſis* Guttis immiſcet; *Salina* ſpicula intra Matricem adacta Fluorem *Bituminoſum* ſiſtunt, & ſi nullæ Suppetiæ *Bituminoſarum* Guttarum a Calore ſubmittuntur, Gleba pro Modulo incunabuli, quod intra *Lignum* ipſi conceſſum, formam ſubit, omnique Exhalationum motu ſopito, Caloreque evaneſcent, *Salinæ* particulæ Rigorem recuperant, *Bituminoſis* ſuperfluum Humorem exhalantibus; Sociatæq; *Succineam* Gemmam producunt; Nitidiorem, Splendidiorem Fragrantiorem, Firmiorem, ex Puritate & Proportione exhalationum *Bituminoſarum* ac *Salinarum*. Hæc vera *Succini* eſt Generatio, quam ante nos nemo Erudito Orbi Perſpicuam reddidit.

Aliquibus tamen is ſupereſt Scrupulus, an eadem *Succinorum* quæ Mare ejicit, Generatio ſtatuenda? Verum cum in Vulgus hic locorum jam Notum ſit, ex Collibus Marinis Tempeſtatum vi disjectis aut convulſis *Succina* prodire, quæ a Fluctibus ad Litus advolvuntur, Capturæ fructuoſæ aut inanis, ex Collium iſtorum Divulſione, leviori aut profundiori, ſumpto Indicio; Qui, inquam, cum Hauſtilia *Succina* intra Colles Generari certum ſit, alius Modus intra hos Generandi reddetur vero ſimilis? Sane in Collibus *Submarinis* non minus quam in Litoris Naturæ Officina erit inſtructa: addo, quod inter Ejectamenta Maris & *Lignorum Foſſilium* copia in Litore *Sudavico*, æque ac in *Neringienſi*, reperiatur: quid ſi Colles Alluvionibus obtecti, qui quondam Terræ Pars fuerunt? Si quoq; in Collibus ſubmarinis reliquorum Mineralium eadem *Generatio*, cur non & *Succinorum*. Cæterum ſicubi extra Matricem Lignoſam, in Luto Cæruleo, in Terra Corticoſa, Flava, Sabuloſa, Vitriolica, *Succinum* naſci contigit, ne tunc quidem alia Ratio *Generationis* Suberit: pariter enim ex Bituminoſis Exhalationibus in Guttas condenſatis *Salium* juſta Miſcela, iſtæ Glebæ pronatæ fuerint. Neque tamen ubicunque reperitur ibidem & Nativa *Succina* ſedes illico aſſerenda, per Maris enim vehementiam a Matrice avulſum in aliena loca ſæpe rejicitur. Quin & Animalium ventriculis recondita *Succina* novi; viſceribus patefactis exempta Amici Dono miſerunt: nec tamen in Animalibus *Succina* Generata dicemus. Ex Accolis Litoris *Sudavici* addidici, omnis Generis Animalia, Terreſtria, Aquatilia, Volatilia, avide *Succineas* Glebas deglutire, adeoque intra Mactatorum Viſcera non raro obſervari. Corvi & Cornices tanta Copia ingerunt, ut egerere rurſus veſperi cogantur & Minutiæ complures ſub Arboribus, in quibus conſident, inter Excrementa reperiuntur. Ab Aſellis (*Pomucheln*) deglutitæ plures mihi obvenere, inſignior trium *Digitorum* Tranſverſorum Longitudine, duorum Latitudine ſpectatur. Eſt ex Ove Globus *Succineus* Mirabilis, quem Cruſta Gypſea Mucus Ventriculi obvelarat, qua ab *Electrotoreuta*, imprudentor abraſa, patuit ex pluribus Glebis, a Calore Animalis ſubactis, fuiſſe formatum.

Et Mare & Terra itaque in *Pruſſiam Succinea* Dona confert: ſed Maris Dona partim in Litore leguntur, partim ex Aqua hauriuntur: Vadoſo *Soil* Mari, ſignis apparentibus, Coloni Reticulis Conto affixi Fundum verrunt, aut Fluctibus volventibus eadem adverſa opponunt; hæc quæ Hauſtilia: reliqua, inter Ejectamenta, quæ natantia prædæ Indicium faciebant, Algarum, Sarmentorum Lignorum, aut Arenarum, ſedulo inveſtigantur & ſeliguntur, lactaque audiunt.

Ex Terra vero, quæ fodiendo acquiruntur, Foſſilia appellantur: Amam longiori Conto præfixam venæ in Montium Litoreorum jugis conſpectæ, admovent, tentando ſicubi Glebam Ligno immerſam offendant, qua animadverſa Lignum leniter radunt, imaq; ſubjecta Glebas excipiunt, exceptaſque adducunt ſacculoque a Collo pendulo indunt. Foſſio vero ad Venarum ductum Priſcis ignota Magni *Frid. Wilhelmi* auſpiciis primum Montes Exercuit. Nec tamen ubique Foſſioni patet Litus, ſed certorum *Receſſuum* juga iſta opera fatigantur; *Eroſs*, *Gubnicken*, *Ekroſs*, *Dirſchkeim*, *Warnicken*, *Strobſchnec*, *Palmnig*: & ſicubi Matrix Lignea ſe conſpiciendam præbet, atque ad eandem facilis ac tutus eſt Aditus.

Succinum uti ex Matrice producitur, quod in Foſſorum operas intentus ipſemet expertus ſum, Rigidum & durum tactu dignoſcitur: Contingit aliquando Frangi dum protrahitur, ſed vitio Glebæ; ſuccinum enim ſuccino Duritie præſtat. Non pauci tamen & Priſco & Noſtro ævo *Mollia* ac Liquida, quidem ab altera parte Dura ab altera Mollia *Succina* ſibi viſa jactitarunt: Quæ mihi iſto nomine Oblata, nec Fragrantia nec Sapore, nec Deflagratione, ſe *Succina* probarunt; caſui itaque inter Hauſtilia reperta *Bitumina* iſtis Auctoribus in *Succineum* Cenſum referre placuit. Verum & Picea Gleba, & Carbo Foſſilis, & Segmentum Pice navali abductum, aliaque plura una a Fluctibus Maris in litus projecta, iſta ratione *Succinei* Cenſus habenda forent. Opinio, quæ in Fundo Maris ſcaturigines *Liquidi Bituminis* commenta eſt, ut a ſalſugine Maris Coagulatum *Succinum* haberet, *Mollia* iſtius modi *Succina peperit*: Neque Hauriendo, neque Fodiendo, neque legendo, ſibi *Mollia* cognita, illi qui Rerum *Succinearum* aſſiduam Curam gerunt, aſſeverarunt omnes. Ipſe, Magnos *Succinorum* Rudium acervos perſcrutatus ſedulo, nullum *Molle* adverti, quod Virtutis Experimento *Succinei* Generis agnoviſſem. Vulgo perſuaſum eſt, Diſcrimen Foſſilia & Hauſtilia intercedere Duritiei potiſſimum, & Puritatis, ac Cruſtæ diverſis Notis. Verum falluntur, qui iſtud in Animum inducunt ut Credant: Evenit ut extra Matricem alienis in locis ſepultorum Robur aut Calor aliquid vitii contrahat, craſſiori etiam Cruſta ſuperinducta; hi tamen Caſus Nativorum differentiam minime inferrent: Æque intra Colles ſubmarinos, ac intra litoreos, pro varia *Bituminis* & *ſalium* Copia ac Virtute Nobiliora & Ignobiliora *Succina* Generari certus ſum.

In Glebis *Succineis* Formandis mirum Naturæ elucet Ingenium: Ut in lucem eduntur; Pira, Amygdalas, Cepas, Piſa, aliaſque Fructuum ſpecies, aut peregrinorum Corporum ſimulachra, vario luſu referunt; Guttarum his apud *Electrotoreutas* Nomen, quum Globoſam Figuram maxima ſui parte exprimant. Major Pigmentorum in Cruſta denudatis admiratio: Literata Naturæ *Succina* plura vidi: Teneo in quo Albeſcens linea Flexu ſuo concinne Literam S. *Latinorum* formavit, reliqua fruſti facie flava: *Arabum* ac *Hebræorum* Characteres quædam ruditer exhibent. Præterea Arbuſcularum, Frondium, Nubium, Ruderum aliarumque quarumcunque rerum Delineamento in *Succino* Variegato curioſus Oculus advertet. Eſt mihi Pectore tenus efficta ſenilis Imago, in ulna infantem reclivem monſtrans; *Jeſus* parvulus in *Simeonis* amplexu hærens animo obverſabatur, quando primam hanc Naturæ Picturam intuebar.

Cæterum & quæ ſuccinis Concreta adhærent, memoratu non indigna puto: Inter hæc Algæ veſicularis & tenuis Folia Rami, radicibus firmiter infixis, ex ſuccineis Glebis propullulantes inveniunt locum; tum ſilex parvulus, eminentiori libera, latiori parte ſuccino obvoluta: Alii Glebæ Lamina ferrea agglutinata eſt: Et Segmenta Lignorum, Conchylia, variaque alia adnaſci contingit.

Animalculorum ſuccinea Funera, jam *Plinio* & *Martiali* celebrata, intentiorem Curam expoſcunt; ultra Triginta ſpecies Inſectorum in meis *Succinis* numero; Muſcas, Araneas, Culices, Formicas, Papiliones, Apes, Millepedes, Teredines, Curculiones, Erucas, Scarabæos, & ex Cornutis & Deauratis aliquot; & quorum nomina memoriam ſubterfugiunt. Sunt qui & perfectiora Animalia *Succino* condita memorant, Ranas, Lacertas, Piſciculos; Quibus ut fidem habeam ægre a me impetro. *Hermano* decantata Ranæ & Lacertæ ſepulchra non uno modo mihi ſuſpecta redduntur. Piſciculos fraude Artis *Succino* incluſos, jam aliis animadverſum eſt. Nativa Animalculorum *Succinea* faretra ab Arte elaboratis, illo maxime diſtinguis, quod in iſtis non procul a ſuperficie, inſecta implicita reperiuntur, in his vero meditullium occupant; *ſcil.* Artem non ita feliciter occultarent *Electrotoreutæ*, ſi extimas partes excavarant, illiſque Animalcula crederent, Tranſlucida enim *Succinea* Lamina fraudem proderet. Si quoque ſolidum, purum, nullis Fiſſuris hians, nec Cruſtarem Compage diſtinctum eſt *Succinum* in quo ſepulta ſunt, illud non a Natura fabrefactum ſcias monumentum; Pleræque enim Glebæ *Succineæ*, quibus Animalculorum Exuviæ ſunt repoſitæ, id quod Millies contuitus ſum, corticatim cohærent, aut Fiſſuris hinc inde ſunt interſectæ, ex quibus & pars Exuviarum aliquando exterius conſpicienda prominet. Neque omnium intra *Succinum* reconditorum Animalculorum par eſt Conditio: Alia ſitu obducta, alia nitida, quædam *Succineæ* fulgore ſplendentia intueor: Duas Apes & Erucam Nidumque Curculionis ſitus obtexit; ſcarabæus fulget, ex Muſcis quædam nitent. Porro alia Vivacitatem, alia Languorem præ ſe ferre, nonnulla quaſi Evigilantia, cum Conatu vinculo iſto ſe extricandi, conſpicies: Quædam *Succina* Integrum Examen Inſectorum, & ejuſdem & diverſi Generis, involutum commonſtrant.

Vexata hinc Curioſorum quæſtio, quomodo *Succinum* Animalcula oppreſſerit? Non pauci Difficultate Quæſtionis permoti Fœtum Arborei ſucci *Electrum* contendunt, quaſi Reſinis aut Gummi Arborum adrepentia Animalcula irretirentur facilius: Verum abſque Experientiæ ſuffragio; neque in Reſinoſis aut Gummoſis Stillis hunc in modum, ſi recte memini, incluſa Inſecta magno numero, ſi modo ullo, Curioſitas hactenus detexit, extrinſecus adhærentia conſpeximus, non ita Fuſo liquore obtecta. Alios Gravitas Argumenti eo adegit ut negarent eſſe quæ in *Succinis* videntur Animalcula, Phaſmata ludos iſtos dare. Sed Fractorum aut ſectorum inſpectio hos refellit, manifeſta enim Inſectorum ſuperſunt Indicia, licet enim Corpuſcula Animalculorum vis *Bituminoſa* ita ſubigat, ut Fibris *Succineis*, *cinis* intercurrentibus viſcera condenſata in Lapidem indureſcunt, quando facilis per rariorem Texturam Inſectorum Effluviis *ſuccineis* eſt Commeatus, tamen Corporis alieni habitum luculenter diſcernere datur; Apumque noſtrarum Exuviæ, interaneis conſumptis, iſtud ob oculis egregie ſiſtunt.

Funeſtos itaque Caſus, quibus Inſecta a *Succinis* ſunt oppreſſa, ut rectius percipiamus, repetendum Memoria, quod inſectis uſu veniat, ſi quando Tempeſtatum aut Hyemis Injuria compelluntur, Cavernas & Latebras ubique quærere, inibique ſomno ſepulta deliteſcere. Quare cum & Litorea Latibula non unum Genus Inſectorum ſubintret, in illiſque aliquando hæreat invitum, aut obdormiſcat, Exhalationibus *Bitumiminoſis* a calore ſubterraneo in laticem collectis, ubi in Matricem *Succini*, quæ Latibulum ac Dormitorium interea præbuit, Liquor deſtillat, eadem implicat & obtegit, Gremioque ſuo ſuſcepta, quando *Succinum* evaſit, commonſtrat. Contingit Beſtiolas in Dormitoriis iſtis a Calore ſubterraneo excitari; aut in vivas Fluor *Bituminoſus* impingitur; ſed cum nullum vigilantibus patet Effugium, eandem cum dormientibus ſortem ſubire coguntur, ut tamen ſortis tunc ſuæ in ſepulchris ſuccinis relinquant Memoriam, Vivaciori, atque Animoſiori corpuſculorum Simulachro. Firmat noſtram Sententiam iſtud, quod *Succino* ſepulta inſecta pleraque ſint ex illorum Genere, quæ Cavernas in Dormitorio eligunt. Majorem partem etiam languida ac ſomnolenta, aut mucoſa tranſparent. Vivacia, quæ cum Niſu obluctantur, aut Alas expandunt, abitumque parant, rariora puta ſed tantam Vivacitatem, quæ Amoris Æſtu in Coitum, Animalcula concitarit, ut iſto nexu Cohærentia *Succineus* Latex involviſſet. Hoſpitio huic ſubterraneo minime convenire autumo; Quare quæ Culicum Muſcarumve iſtos Hymeræos oſtendunt faretra ſuſpectis adnumero.

Specioſiora alia nunc depromam quæ Plantarum Germina ſinu ſuo obvelant. Eſt mihi in quo explicata Algæ Veſicularis Folia Alas Aquilæ, expanſas & Pedes cum Corpore utcunque adumbrant. Aliud Semen Tiliæ, ſtipitiſque partem; aliud Folliculum, diductis Foliis hiantem, quatuorque Semina complexum, ex quibus Apex medius exſurgit, Cauliculo ad Superficiem protenſo & prominente; eſt quod Muſcum, in Pergulæ S. Porticus Hortenſis ſpeciem, Fornicatis Operibus compoſitum obtutui ſiſtit. In alio Floſculus minimus marceſcens, in altero Roſmarini Sylveſtris, *Pruſſis Korbi* dicti Ramulus tribus Foliis diviſus tranſparent; Rude aliud Algæ memoratæ Veſicularis Ramum majorem per Corticem non politum oſtentat. Plura ex Muſco villos disjectos obtinuere; Nobile autem illud, in quo Pars albeſcens Convallem & Colliculum Muſco inveſtitum exhibet, ſed per Speculum quaſi, quando ex Flavo ignei Coloris *Succino*, huic amæniſſimo Spectaculo mirabili Naturæ Artificio quaſi Vitrum eſt objectum, per quod Muſcoſi apparatus delicatior eſſet Aſpectus: Nec vile alterum aqueo lacteſcentis Coloris, quod Villorum Muſcoſorum criſpata Congeries nobilitat. Spectabiliora hæc Herbarum *Succinea* Monumenta quam illa Animalculorum cenſeo. Major Copia Corticibus, Lignis & Feſtucis intertextorum; Feſtucæ Pineæ videntur, ſpecie iſtarum quibus Formicæ Acervos extruunt; Verum accuratiori Examini Foſſilis Ligni ac Corticis Monumenta patuerunt.

Ex Minerali Regno quoque adducenda, quæ *Succinis* incluſa: *Vitriolum* ſæpius ſapori prompte dijudicandum; *Pyrites* quandoque, crebrius *Ferrum* de quo *Electrotoreuta* conqueruntur, quod non niſi cum Detrimento inſtrumentorum educatur; Armatura quoque *Aurea* & *Argentea*, divulſis coagmentatis Partibus, in impuro conſpicitur. Sed & Aquæ Guttas intro receptas diverſis Alveis ſtagnantes *Succina* detinent: qui effluit Liquor Salſus aut Subſalſus, aliquando & inſipidus, non exſiccari, ab aliis cum Luna creſcere & decreſcere Liquor traditur; habeo in quo exſiccatus eſt; habeo in quo perennat ſemper idem. Quæcunque autem ex *Plantis*, *Mineralibuſve* *Succinum* complectitur, caſu haud abſimili, dum in Matricem illapſa ſunt, a Fluore *Bituminoſo* obſeſſa atque occupata intelligo. *Aquearum* Guttarum intra *Succinum* occluſarum ſingularis Ratio cogitanda: Udam Matricem calida *Bituminoſa* Exhalatio obſepſit, intro compulſa *Aqua* a calore ſubterraneo conſumi nequiit, & ob Copiam Circumſtantis *Bituminoſi* Laticis nullam Rimam qua difflueret invenit; præcluſo itaque exitu, captiva ſe includi paſſa eſt; Conatum elabendi, quando in Arctum coacta fuit Gutta, manifeſtis Indiciis quædam Glebæ produnt.

Foſſile Succinum declaravimus; Metallis tamen non eſſe accenſendum, vel illud arguit, quod nec ductile ſit, nec liquabile; ſicubi enim in Fluorem deducitur ſoliditati ejus multum decedit, contra quam Metallis evenit. Fuerunt qui *Succinum* fundendi, & parva Fruſta in unam Molem ſalva Firmitate uniendi Artem ſe tenere aſſeverarunt. Ego variis Experimentis, dum Fuſioni *Succini* Operam dedi, fruſtra iſtud tentare didici, ſiquidem ſalium vis, aqua maximum *Succinorum* Robur, inter ſolvendum avolat: nec a Fuga retinetur, niſi addito aliquo; eo ipſo tamen Soliditas corrumpitur. Quod ſi Calor tam blandus admoveri poſſet, qualem Natura in Animalibus humente Vapore miſcet, non deſperandum Arti putarem; Globus enim *ſuccineus* in Ovis Ventriculo repertus ex pluribus minutis coagmentatus eſt, relictis juncturæ ubique Veſtigiis; quæ ipſa nec Fuſorium, ſed tepidum Glutinandis commodum, Ignem a Natura adhibitum fuiſſe indicant. Fuſa ſuccina quibus ſceleta obducta atque ſuccinea Funera venditata, Vernix ſunt, uti amiciſſimus D. *Vogeding* optime monuit. Solvi olim *ſuccinum* & liquefeci, ſolo Ignis adminiculo, nulla alia re admixta, ſed fragilius juſto comperi, imminuta Coloris Gratia, Salinis Minutiis quæ Lateribus Vaſis adhærebant cauſam reddentibus. Multo minus ad *Terrarum* aut *Salium Claſſem* Succinum referendum erit; quum Terris Arctius cohæreat, & *Salibus* ſit pinguius, utriuſque etiam humidius. Ad *Bitumina* & *Sulphura* propius accedit; ut tamen Durities ipſum ab his diſcriminet, tam dura enim ac ſolida pura *Bitumina* aut *Sulphura* nemo indicabit.

Durities vero *Succinum* inter *Lapides*, Splendor inter *Gemmas* collocat; neque Fragilitas objiciatur; Fragilis & *Gagates Gemmaque Gemmis* ſolidiores, nec tamen propterea Loco moventur: *Electrotoreuta* ſatis dura *Succina* experiuntur, alba in primis, ut ferri Aciem hebetent; Tormentaque et mortaria Ludrica, a Pulveris Pyrii Exploſione illæſa, Soliditatem docent. Summa etiam *Succini* ex duritie & ſoliditate Gloria : faceſſant itaque friabilia ac fragilia, quæ Ignobilitate contempta ab Arte rejiciuntur. Sed virtutum quæ ſuccinum a reliquis *Gemmis* diſcernunt, præcipua antiquis viſa *Attractiva*, ut *Electrica* ipſis vocarentur Corpora, quæ facultate trahendi quidpiam ad ſe pollerent ; & celebre hujus Virtutis Nomen *Platonis* etiam ingenium in explicando exercuit. Recentior Ætas, quæ res naturales intentiori *Experimentorum* cura explorat, aliis Gemmis, Lapidibus, Vitris, Bituminoſis, Reſinoſiſque, Sulphuri, Aſphalto, Laccæ, communem vim *attrahendi* advertit. Reliquis tamen *Gemmis* fortius *Succinum* attrahet, ut quod attritum pinguia Effluvia eaque *Tenacia* copioſius emittit : Virtutem enim hanc oleoſis Particulis adſcribendam perſuaſit *Experimentum*, quod de *Colophonia* gemina cepi ; altera enim poſt olei deſtillationem excepta pariter ſe *Electricam* adducenda levia probat ; altera vero, quam poſt Balſami nigri Liquorem exemi, licet *Nitida* & quaſi *Vitrea* eſſet, nullam vim *attrahendi* exſerebat ; Nimirum illa, aliquid *Pinguedinis* retinuit, hæc vero *Capitis mortui* inſtar omni *Bituminoſa Pinguedine* prorſus exuta fuit. Veteres quædam exceperunt, quæ non adduceret ; *Sympathia* & *Antipathia* Miraculo ; perperam admodum, ſiquidem & Ocymum & oleoſa & humida, ipſaſque aqueas *Guttas* a *Succino* attrahi pro lubitu demonſtro, inſigni & polita *Gleba* admota ; eleganti *ſpectaculo*, quando effluviis ingredientibus *Gutta* in *Bullam* adſurgit, aut quando pendula tranſilit. Sed & in Corpus humanum hac Virtute *Succinum* agit : Fruſto Cervici alligato partem, quam leviter attingit, leni Sudore *Humectam* tactu percipies. D. *Boyle*, *Anglia* primo *Europa* eruditæ maximum quondam Decus, *enarrabat* & incredulo mihi aſſeverabat illuſtris Proſapiæ Virginem Globulorum grandiorum lactei Albeſcentis *Corolla* ita affectam, ut os in tremorem & quaſi *Spaſmum* ageretur, quoties Collo ſuſpenſam geſtaret, remota vero *Corolla* Tremorem ceſſaſſe & Convulſionem. Efficaciam autem *attrahendi* Humores in Fonticulis quidam Globulis *Succineis* perſenſere.

Propria *Succino* eſt *Fragrantia*, qualem nulla *Gemmarum exhalat* ; neque ex reliquis Naturæ Fœtibus, *Aromatica* fortis quidquam parem odorem ſpargit ; non *Thus*, non *Myrrha*, non *Camphora*, nec *Maſtiche* : in reſinarum intra Formicarum Acervos abditarum Glebulis imitamentum habes *Odoraminis*, ſed ut in Attritis & Accenſis diſcrimen ſe prodat illico. Diverſus eſt *Flavorum* ſive *Igneorum* ab Albeſcentibus Odor ; illorum pinguia, adeoque *blandiora*, horum ſalſa & acriora ſunt Effluvia, quæ haud ſimiliter *Nares* afficiunt. Peculiaris quoque inter *Gemmas*, *Succinis* eſt Sapor ; ſed & hic variat, uti *Oleoſarum* & *Salinarum particularum* variat *Miſcela* ; Alba Fibras Linguæ pungunt, *Flava* non item. A pleriſque Gemmis & Colorum *Varietate* differunt : Nigrorem refugiunt ; *Opaca rara* ſunt *reperta* ; ſuperant inter *Pura Pellucida*. Denique Levitate parem vix nominabas *Gemmam*.

Princeps Virtus Corporibus Animalium mederi, ad quam *Gloriam* nulla *Gemma* æque accidit ; crudum citra Artis *Operam* eſt ſalutare ; ſive intus ſive extus applicetur, *Indis* & *Chinenſibus* ſuffitus in delitiis habetur, ut in luxum degeneret ; Sed *Catarrhis* ex *Pituita* ſuffimentum prodeſſe vulgus notavit ; *exhalationibuſque Succineis Alexipharmacis* acceptum quondam tulerunt *Electroto-*

reuta Regiomontani, quod ipſi a Peſte manſerunt intacti; certe non efficacior adverſus *Contagia* ſuffitus, quam ex ſuccino; neque ulli ex Fodinis Litoris *Sudavici* graves aut *peſtilentes* erupere unquam *Vapores*. Fluxionibus Capitis *Alba perpolita ſuccina* ſunt proficua, Cervici *alligata* humores avellunt; blanda quoque oculis *Flavorum* affrictio; & Fonticulis *ſuccinei* Globi lenius induntur. In Pulverem contuſum ad *Urinam* ciendam, ad *Calculum* propellendum, ad Muliebris Sexus menſtruum Profluvium movendum, multum valere, ſi cætera ſunt paria, quotidiana loquitur *Experientia*. Dono a generoſa *Domina* acceperam *Calculum* plurium *Unciarum*, duos Articulos Digitorum & ſupra Latum, tres longum, quem carnificem Ruſtica in Sinu Pudoris tres Menſes paſſa erat; dato *ſuccini Albi* Pulvere, *Cochlearis Menſura*, feliciter *Carnificina liberata* eſt; ipſam Aniculam ad me adduci curavi, ut omnia exquirerem *accuratius*. Pariter *ſuccini* Pulvis, Vino infuſus, hinc ſub operculo incoctus, calido Vino epoto, & Urinæ & Calculo, & Menſibus trahendis inſervit, quamvis minus efficaciter. In memoratos *Uſus medicos* præſtat Album ſumere; Salis enim maxima in his enitet Virtus.

Magiſterium Reſinoſum ſalubriter *Pilularum Forma* uſurpatur, nec *Balſamo Copaita* cedet: ſive *Urina cienda* ſive *Pituita generanda*, ſive *Gonorrhaa temperanda*: Idem *Cephalicis Emplaſtris* convenit. *Colophonia Diaphoreticis* quibuſque & Stomachicis Emplaſtris congruit; Commodo maximo ſi adverſus *Paralyſin*, *Apoplexiam*, aut *Epilepſiam*, aut etiam *Gangranam* muniendæ ſunt *Partes*, ſumptu minori: Debilitatos ab *Arthritide* Artus benigne fovet *Oleum ſuccini Europa* & *Aſia* præclarum præbet Medicamen, ſed Imprudentia Medicaſtrorum infamiam incurrit; ſiquidem in *Gonorrhaa*, Calculo & Menſibus ſuppreſſis ſæpe in exitium ægrotis ceſſit; *Parca* ejus ſit Doſis, *Gutta una* & altera aliquot *Drachmis ſacchari* vires impertit: Frigido Pituitoſo Cerebro una *Guttula* Vertici aut Suturis illita medetur, *Goſſypio* excepta Auribuſque admota *Flatus* & *Tinnitus* diſcutit, *Ambuſtas* Frigore partes reſtituit; Partui difficili fert opem, quod vel Veterinariis in *Pruſſia* innotuit, quamvis his pulvis magis in uſu. *Oleum* autem eligendum quod Aerium, nulla ab Igne nota *Empyreumatis* impreſſa, Albeſcens, ſubtiliſſimum & fragantiſſimum. *Salis Volatilis* ſuccinei contra *Epilepſiam* alioſque Affectus Cephalicos a *Pituita* oriundos decantata eſt Medicina: Sed & Dieureticum inſigne præſtat. *Eſſentia ſuccini* eſt *Olei* ſubtilior portio, adeoque eadem de hac tibi promittis commoda, ſed quæ Spiritus Vini Mixtura diluta eſt largius in uſum aſſumi poteſt: valet quoque ad *arcendam Gangrenam* extus. Sunt qui *Phlegma* medicamentis adnumerant: Sed quodcunque ipſi ineſt Virium, Olei atque Salis reliquiis debetur, quibus ſi privatur *Fatuum*, ac *fumoſis Exhalationibus* imbutum reſtat. Quod poſtremum deſtillat craſſum Oleum non niſi vulgo in Frigidorum Artuum Medelam conveniet, *Empyreuma* enim graveolens reddit, ut ſatius æſtimem iſto abſtinere, & Colophoniam integris Viribus ſervare.

Illud unicum adjicio, me juxta *Analyſi* ductu Naturæ pura ab impuris ſeparando, blando in ſubſidium *advocato Igne*, vires ſuccini omnes ita coadunare, ut *ſalva Fragantia nativa*, Pinguium & Salinarum particularum ſalva quoque *Efficacia*, externo internoque uſui idoneum Remedium evadat: *Balſamum ſuccineum* voco, in quo remotis Terreſtribus Graveolentibus partibus volatiliores atque delicatiores amiciſſimo Fluoris nexu Arctè cohærent, nullo *Alieno* in ſocietatem admiſſo. Quicquid a *Succino* Crudo aut Arte quomodocunque *præparato* expectari poteſt, citius, tutius & jucundius a noſtro *Balſamo* præſtabitur. Interne forma *Pilularum* commodiſſime aſſumitur, aut Boli; Externe Apoplectici, cujus & Colorem præ ſe fert, *Balſami* in modum applicatur, Gingivis, Linguæ, Palato in *Deliquiis*, in *Paſſionibus Hyſtericis*, *Epilepticis*, *Paralyticis*, cum fructu affricatur: Prophylaxeos ergo quavis ſeptimana bis terve *Grana* 5, 7 10, imo 15, tuto uſurpantur, ſimiliter in Renum, Veſicæ, Genitalium certis Morbis, admixtis Anodynis, contra Tinnitum aurium quam Oleum affert Medelam, at certiorem. Non male apud *Hoſmannum* & *Etmullerum Balſami Peruviani Gratia* Oleo ſuccini jungitur. Aſt felicior *Peruviani* & noſtri *Balſami ſuccinei*, adverſus Gonorrheam & Fluorem Album imprimis, ſocietas erit.

Succinei notior eſt Diſtillatio, quam ut deſcribi opus habeat. Et XX. & retorta huic negotio inſervire valent, verum per Rimas multum Olei & Salis elabitur ſi XX adhibes, Vehementiſſimam enim Olei & Salis vim nullum *Lutum Philoſophicum* coercebit, præſtat igitur Retortæ opera uti. attendendum autem ut alba ſi ſalis ſi Olei copiam elicere ſatagis, ut Flava eligas; ex lbj. Albi recepi Salis volatilis ½ *Oun.* quum ex Flavi lbj. *viij.* elicias. Felicius quoque & ſuavius Oleum proveniet, ſi polita *Fragmenta* aut nitida, tenui Cortici lucida fruſta, quam ſi impura, *Craſſa Cruſta Inveſtita*, aut vulgarem *Raſuram* adhibueris, nihil autem ſuccino eſt admiſcendum, quamvis Silices & Arenas addere olim fuit in uſu. Abſit Ignis vehementia, ex Arena Calor leviter intenditur, atque juſto Regimine mox cum Phlegmate Ætherea Olei portio aſcendit, quam limpidam peculiari vaſe excipies, ubi Flaveſcens Oleum prodiit cum Sale Volatili ceſſet Deſtillatio.

Urgeri quidem poteſt Succinum, ut craſſum Liquorem nigrum fundat, parumque capitis Mortui nigri & ſplendentis inſtar Colophoniæ erit reſiduum, ſed hoc omni virtute Olei & Salis eſt ſpoliatum, ex lbſs. Albi reſtabat *Oun.* hujus Capitis Mortui. Sed præſtat aliquas Colophoniæ vires relinquere, quando gratior hujus præ fœtido nigro Balſamo eſt uſus. Sal Volatile, quod ad Roſtrum Vaſis evolavit, aut Lateribus adhæſit, calida Aqua abluitur, atq; ut ab Admixtis Oleoſis particulis ſeparetur, *Charta humectata* ſolutio percolatur, tranſeunte Sale, reſiſtit Oleum, a *ſolutione percolata* poſtea ſuperfluus Humor abſtrahitur, ut *tertia Pars* relinquatur, quæ frigori exponitur, atque Angulatæ *ſalis* concreſcunt Cryſtalli, Miliares quaſi ſive grandinoſi. Alius eſt modus Sal depurandi, ſi fæculentum vitro longioris Colli inditum Cinerum aut Arenarum Calori exponitur. Nives enim Floccis, ſive Spiculis ad ſubliniora Loca evolantibus, in Fundo impurior pars hæret, verum hæc Operatio cum jactura Vitri & Salis eſt conjuncta. Quidem & Phlegmati ſeparando ſtudent, verum rectius hoc cum *Aqua*, quæ *Sal Volatile* imbibit, jungitur, ut pariter Sale ſua exuatur, neque *reiterata* Deſtillatio illi conciliabit Virtutem, niſi a *Sale Volatili* illam acceperit, nec Gratus Phlegmatis Odor, ut in Salis Volatilis Conſervationem commendari poſſet.

Accepi ex lbſs. *Albi Phlegmatis* ½ *Oun.* quod Salis ſuccinei ſapore erat imbutum, repetita autem deſtillatione fumum ſolum ſapiebat, cætera Fatuum & ingrati odoris. In Colophonia, ſi non prorſus fuerit exuſto, aliquid Salis latitat, quod ope Aquæ calidæ, mora quadam *Macerationis* educes: nonnullis hoc Sal fixum Succini audit; non recte, quia parilis Volaticæ eſt Virtutis, Sapore & Odore eodem: Colophoniæ autem virtutem hoc quodcunque eſt Salis intendit. Oleum omne, at alia opera depuretur non opus eſt, modo Recipiens vas juſto tempore mutetur, atque rite inſtituatur Deſtillatio, puriſſimum ſtatim accipies. Qualitates Olei ſuccinei ex Bitumine ſive *Oleo terræ* ſunt derivandæ, qua in re Ol. *Borrichio* minime refragor; ſed quod idem omnes virtutes ſuccinei Petræ Oleo vult communes, in hoc diſſentio; alteratum enim Succineum Odor & Sapor ab illo Olei Petræ aut Terræ diverſus demonſtrat; at Olei ex Ligni foſſilis deſtillatione, odor olei Petræ, non autem ſuccinei Odori congruit: Credo autem Alterationem Olei Terræ in ſuccino Salium intimæ deberi Combinationi. Quænam vero iſta ſint Salia determinare non licet, illa ipſa tamen erunt quæ Succini Sal Volatile ſua *Miſtura* progenerant. Nullum enim eſt ſuccinum, cujuſcunque ſit Coloris, quod Sale volatili deſtituatur, atque a Sale volatile omnis iſta peculiaris *Fragrantia*; quantoque Sale abundant, tanto in attritu *Fragrantiora* experieris. Ut autem temerarium Naturæ *Arcana* definire, ex vitrioli tamen *Martialis* Corpore Sal iſtud ſuccineum majori ex parte componi citra Crimen Audacter aſſero; etenim in Albis Sale volatili inſigniter pollentibus, & Odore & Sapore Chalcanthum tale manifeſto deprehenditur. Sed minime communi vitriolo Sal ſuccini adſcribimus; *Vitriolum alteratum* ſit oportet, quod tale virtutis ſingularis Sal volatile producit. Eſſe autem *Vitriolum Pruſſicum* ab aliarum Regionum *Chalcantho* diverſæ Naturæ, Analyſis inferius declarabit.

Certe ab Acido Originem trahere Sal Volatile, Acidus, iſque non ingratus ferme vinoſus Sapor arguit; ad *Spiritum Vitrioli Philoſophicum* proxime hæc gratia Acoris in Sale volatili ſuccini accedit; pungit, minime corrodens, affuſoque Spiritu vitrioli non efferveſcit neque ebullit, nec conſumitur, cum Sp. *Salis Armon.* commiſſum Bullulis excitatis cum ſtridore abſorbetur. Subtiliſſimum hunc & gratiſſimum volaticum Salis ſuccini acorem Moderationi Bituminoſarum exhalationum vindico, quemadmodum Sp. Vini cum Spiritibus Nitri aut Salis combinatus, hos mitiores reddit, ut dulces audiant. Siquidem dum Bituminis Particulas diſperſas Calor ſubterraneus in unum cogit, fit ut hæ per Ditiones vitrioli tranſitum faciant, quas dum permeant, ſubtiliſſima vitrioli Effluvia eodem Calore excitata ſecum rapiunt, minori, majorive Copia, atque in *matricem ligneam* auferunt ut junctis ſeminiis Succinea pronaſcatur Proles.

Succini qua in Pollinem terendo redigitur, levior eſt *præparatio*, equidem parum intereſt, pulverem contendendo an terendo minutum exhibeas, ſc. utroque modo prodeſt, vel Brutorum exemplo, quæ avide *ſuccinorum* Minutias devorare annotavimus. Verum tamen quod Diviſio in minima ad faciliorem commiſtionem cum Succo nativo animalis diſponit, non inutilis in medicina iſta erit opera. Infuſionem *Succini* aut coctionem præterirem, niſi inter

Euporiſta Domeſtica merito hæ Præparationes locum ſibi dari poſcerent: certum eſt, quod Virtus ſuccini coquendo in vinnm tranſeat ; ſed infundendo atque digerendo vinum ſuccino Medicatum impetrabis. Eſſentiam ſive Tincturam affuſus Succino Sp. Vini parat; qui tamen a puris Albis Flavedine non tingitur ; an *Sp. Vini* igneus præſtet, an dilutus, in dubium vocaveris, illum enim Oleoſæ hunc Salinæ partes depoſcunt, verum cedit Succinum utrique & per digeſtionis quamcunque moram neceſſe eſt ut Sp. *Vini* tandem reddatur dilutior, præferendus itaque generoſior. Felicius autem *Tinctura* proveniet, ſi *Ramenta* tenuiſſima cum Sp. Vini ſociaveris: quidam *Ol. Tartari* per del. aut *Salis Fixati* addunt, aut his Sp. Vini acuunt, ut major virtus & ocyus in Spiritum tranſeat, non male, niſi quod Alieni Particeps hæc evadat *Tinctura*. Sed & Ebullitione in vitro oblongi Colli Succinum felicius diſſolvitur, ut virtus prompte ſuſcipiatur, & Spiritus illa ſaturetur penitus, id quod ſola Digeſtio longiſſima Mora demum aſſequetur.

Majores Magiſterium ex Succini Extracto per acidum redigere ſategerunt, nullo Opere Prætio, ſi Acidum Succini Pulveri Aſſociare cupis, Terendo idem aſſequeris rectius. Præſtantius Magiſterium dabit *Tinctura abſtracto* Sp. Vini Reſinoſum iſtud eſt, imo ipſa Reſina ſive Oleoſa Pars Succini qualemcunque Mutationem paſſa ; ſiquidem Sp. Vini quem deſtillando recipis Succineis Viribus impregnatus intimam ſui cum ſuccino unionem indicat.

Ligni Foſſilis Fragmenta contuſa *Aqua Calida* maceravi, Lixivium ſubdulcis *Aluminoſi* aut *martialis* potius erat Saporis, ut ægre tandem aliquid *Vitriolici* perſcentiſceres ; ſed ad *Chryſtallos Salinos* congregandos inſpiſſatum, magis atque magis *Vitriolicum* Saporem prodebat, ipſique *Cryſtalli* eundem referebant, niſi quod primum *martialis* Dulcedo Linguam afficeret : id quod repetendo Solutionem & Corporationem in *Cryſtallos* denuo expertus ſum. Exutum Sale Lignum Retortæ indidi ; & Calore Arenæ intenſiſſimo, ut intra vitrum *Fragmenta* canderent, omnem Humorem elicui : Lacteus prorſus erat Liquor qui prodibat, ſpecie Emulſionis *Amygdalarum*, quadam poſtea in Superficie Cuticula, & ſubſidentibus in Fundo Particulis Calciformibus. Odor Graviſſimus Sulphureus qui totum *Hypocauſtum* illico *pervadebat* : ſed propius admoto Liquore *Nares* Succineum quid percipiebant, non quidem *Fragrantis* Glebæ aut Olei, ſed *Phlegmatis* ut poſt Deſtillationem in *Retorta* Reſidui : *Sapor* quoque qualis *Phlegmatis*, Fumoſus ab *Empyreumate*, Salſo Aciduli quidpiam Guſtui intermiſcens. Lacteus Color in Liquore poſtea diſparuit, Pinguiori *Relicta Cuticula*. Denuo Partem Igni feci exponi, ſi qua *ſal Volatile* & puriores Olei *Guttas* reiterata Deſtillatione exciperem : Verum Salis volatilis nihil aſcendit, Oleoſæ autem Particulæ ſubtiliores *innatabant*, non amplius in modum Cuticulæ cohærentes ; quædam etiam Forma Globulorum Pellucidorum Fundum petierant, Igneo Succini Colore conſpicuæ. Exigua Portio *Olei*, aliquot Guttarum ex lbj. Liquoris, Sapore & Odore Oleum Petræ prorſus Imitabatur. Globuli vero, ut in Fundo Reſinoſi apparerent levi concuſſione Liquori commiſcebantur. Calciformes Particulæ tenuiori terreſtri Portioni adſcribendæ erunt, Ignis vi ſurſum elatæ.

Lignum ex Retorta exemptum Brunno Ferruginei erat Coloris, multum *Sulphuris exhalabat*, Accenſum inſtar Fomitis Ignem alebat, Superficies ejus leviter Rubro Pulviſculo conſperſa fuerit.

Crucibulo impoſitum per tres Horas Ignis exercuit, refrigeratum pariter *Cinnabarino* quaſi Pulviſculo obtectum fuit: Flammæ admotum minus prompte Ignem ſuſcepit; neque diu detinuit, nedum ut Fomitis inſtar *propagaſſet*, ſpirabat autem *Sulphur* Auratum, hujuſque Saporem Commanſum præbuit; Accenſum vero minus *Sulphuris exhalabat* quam quod in *Retorta* erat Relictum: Colore etiam lucidiori. Denuo in Crucibulo ultra novem *Horas* detinuimus, neque Accendi amplius potuit, ſed inſtar *Amianthi* Album poſt Ignitionem comparebat, nullo Sulphuris Odore. Color poſt tam longam in Crucibulo Moram ex *Griſeo* Partim Nigricans, partim ſplendens; Microſcopii ope aliæ partes inſtar Scoriarum, aliæ inſtar Chryſocollæ, aliæ inſtar Calcis efformatæ Dignoſcebantur. Toſtum atque Exuſtum ſatis *Lignum* Felle Vitri admixto, Igni Fuſorio expoſuimus; & facile coierunt in *Maſſam*, quæ Granulæ diſparſa *Reguli Martialis* exhibuit poſtea. Dum vero in unum Corpus iſta *Granula* fortiori Igne cogere intendimus, *Colliquata* cum Regulo Maſſa, ex Nigro ſplendens, Vitrea producta eſt.

Nativum Vitriolum, ſive illud *Amianthi-forme* ſive Fuſum alterum, attritu *Chalybis* prodit ſibi non cum *Venere*, ſed cum *Marte* Societatem initam; nullam enim Cupri indicem Rubedinem relinquit. *Nativum Amianthi-forme* ſolutum & in *Cryſtallos* redactum idem confirmat, ſubdulcis enim ac plane *martialis* primo ſenſu percipitur Sapor, qualis Salis ſive Solutionibus Martis Chryſtalli non iſta Specie qua *Goſlarienſe* concreſcunt; Solutionum autem prius depurgavimus affuſa Urina, atque ſemotis Fæcibus concrevit *Terra Foliacea*, reliquus Liquor *Cryſtallus Sappharini* ferme Coloris inæqualibus Angulis exhibuit. Cæterum ex Solutione inſpiſſata hincque *Filtrata*, ſuccedente Evaporatione, Album *Oleum* prodiit, quod Furno Piſtoris leviter Calcinatum Loricatæ Retortæ inditum *Sp. Vitrioli* intra 24 Horas fudit Egregium, qualem ex *Oleo martis* alias Officinæ parare ſolent. In *Colchotare* multum Salis Olei adhuc latere, ope Microſcopii exploravimus, ut pateat quomodo Oleum in Colchotare Aeri expoſito regenerari intelligendum.

Terram Corticoſam ejuſdem cum Ligno Foſſili eſſe Naturæ Ignis Examen confirmavit; Leviori Toſtione Opus erat ut ex hac aliquid Metallici eliceremus, licet quod obtinuimus Exiguum eſſet. *Ex Luto Cæruleo* olim per Deſtillationem Spiritum Nactus ſum Volatilem *Sulphurei* Odoris & *Bituminoſi* quid in *Superficie* comparebat. Terram vero *Flavum* ad Martem inclinare adverti, & *Vitriolici* aliquid traxiſſe ex Confinio Sapor arguit & Odor.

Inter *Regias Opes* antiquiſſimis Temporibus *Theſaurus* hic *Succinorum* repoſitus fuit *Regibus*, qui Terras *ſucciniferas* tenuere jam olim *Succina*

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colligentibus; ut Magnificentia Munerum aliis pares eſſent. Apud *Solinum*, *Rex Germaniæ (Pruſſiæ* intelligendus, quam *Germania* tantis opibus *ſuccineis* nunquam gaviſa ſit) tredecim millia Librarum *Neroni* Donum miſit, non unius ſed plurimorum annorum congeſtus Acervus. *Pruſſia* inter Regalia *Crucigerorum* ordini *ſuccina* vindicavit, aliquo in eadem Epiſcopi *Sambienſis* jure. Atque publica Autoritate Collectio eſt inſtituta, ſeveris in depeculatores legibus. Seceſſione Civitatum ordinis Ærarium acciſis *ſuccini* reditibus non leve detrimentum paſſum eſt, quamvis obnixe omnia ageret ut integro Theſauro ſolide potiretur. Poſt *Cruciferos* Ducum *Pruſſiæ* quæ fuerit in ſeverandis Fiſco *ſuccinis* cura. Annales potius eloquuntur: Deſtinati tamen operi memorantur Litoris *Sudavici* Coloni, quibus ex Capitaneatibus *Schakenſi* & *Fiſchuſiano* additi ſunt alii: Servituti non ſtati dies, ſed ſi quod capturæ tempus commodum, diu noctuque, Hieme æque ac Æſtate. Stipendum his, Domus inſtructa & Agellus, atque a Tributis immunitas; hauſtique vel Lecti *Succini* modius modio Salis redhoſtitur. *Foſſili* præſens pecunia adjicit Auctarium. *Crucigeri* Dominum *ſuccinorum* vocabant qui *ſuccineis* rebus præerat; alicubi & Commendatoribus iſta Cura incumbebat. Sub Divo *Alberto* Magiſtrorum atque poſtea Camerariorum nomen frequentius fuit, Equeſtris dignitatis viris hoc Munere defungentibus: Noſtra Ætate partem muneris capit Capitaneatus *Fiſchuſani* Præfectus, partem *Feloniorum* Director, Adminiſtratore Litoris peculiari. Adminiſtratori Cuſtodes Litoris Equites (*Dimond Keuteh*) præſto ſunt; Equitibus autem adjuncti ſunt ſervi Cameræ (*Hunmer Muſta*) qui Pedeſtres cum Equitibus Munus cuſtodiendi alternant, quandoque ſi opus eſt, & horum vices obeunt.

Adminiſtratoris Officium eſt ad operas ordinandas juſſa edere, *ſuccina* undique recipere, congeſta *Regiomontum* tranſmittere, Furta præcavere, de inventis diſceptare, & Regale ſereniſſimi ubique inviolabili præſtare. Hujus etiam eſt Sal Colonis diſtribuere. *Equites & Servi Cameræ* Litus de die obequitant aut circumeunt, ne quis *ſuccina* tollat; iidem tempeſtates obſervant & Colonos ſi hauriendum fodiendumque convocant, Foſſumque & Hauſtum recipiunt. Nulli Colonorum *ſuccina* detinere Domi licet, ſed ad *Equitem* aut alium, cui iſtud delegatum deferunt; quæ in *Pillaviæ* & *Neringiæ Recentioris* Litore leguntur, ſcriba *Felonii* ab his ſuſcipit. Si quando Anguſtia temporis, inſigniori Copia, in Litore ſeligere non permittet, Domum aſportandi Facultas concedetur: Vi juramenti autem proxima Luce eadem reddunt: Inter hauriendum & fodiendum Operariis Sacculus a Collo pendet, & Furti reus habetur qui veſtimento Glebam abdidit. Recepta a Colonis *Adminiſtratori* exhibentur, a quo *Regiomonti* in *ſuccinorum Camera* reconduntur, atque *præſente Directore Feloniorum* diſcernuntur & divenduntur. Olim plures *ſuccinorum Cameræ* erant, *Lochſteti*, *Dirſchkeimi*, *Memelæ*, *Germoviæ*, ſingulíſque ſui *praerant Magiſtri*.

Extra Litora, *ſuccina* in *Prædiis* Fiſci reperta *Præfectis* ſunt reſtituenda; quæ in privatorum Fundis, ſi non Privilegio Domino vendicari poterunt, Fiſco neceſſe eſt pariter cedant; quamvis hactenus privatis invidendas ex *Succino* opes obtigiſſe non memini.

Quondam privatis *ſuccinorum* captura erat elocata, ut certa Annua ſumma præſentis Pecuniæ 10000 aut 12000 talerorum redimeretur, præterquam quod in Colonos impenſæ erant faciendæ. Verum plus Queſtus ad Fiſcum rediit, poſtquam publica Autoritate non ſolum curata, ſed & divendita ſunt *ſuccina*, certo pretio cuilibet generi *ſuccinorum* ad Menſuram ſtatuto.

Succinea Rudes Glebæ in auctarium pretii diſcernuntur, Capitales (*Haubt Stuck*) aliquot *Unciarum* pondere, carius veneunt; Tornatiles (*Dubly*) *Palmæ* Longitudine ac Latitudine minoris conſtant; minimæ (*Krauſs*) his cedunt. Illis autem, quæ aliquot *Librarum* pondera æquant, nulla certa eſt Æſtimatio. Puritas, Dignitas Coloris pretium adauget; viliſſima habentur impura (*Dibluc*), pretioſiſſima *Alba Lactea*.

Crucigeris Dominis, *Lubecenſes* & *Stolpenſes Succinorum* Commerciis inclaruere: Poſtea & *Gedanenſes* atque *Regiomontani*. Noſtra Ætate *Gedanenſium* maximus ex *ſuccinis* eſt Queſtus, poſtquam Mercatores *Pruſſicæ* ad ſe traxere, *Electrotoreutarumque* Collegium quæ *Neringiæ Recentis* Litus offert, ſolide poſſidet. Cruda *Orientalibus* Populis magno Pretio venduntur; *Armeniique* & *Perſæ* olim *Regiomonto* aſportari curarunt, Lucro Civium non contemnendo. Cæterum As *Electrotoreutarum* majorem Queſtum facit, Sculptura ac Celatura aut Torno varias Figuras inducendo, ut inter pretioſiſſima habeantur ex *ſuccinis* fabrefacta opera. Operibus pretium intendit ſi ex eadem *Maſſa* integra confecta, ſi nobilioribus Coloribus ſunt conſpicua, ſi rariora Naturæ Pigmenta monſtrant.

Primus ego perſuaſi, ut *Italos* & *Gallos* imitentur, qui Effigiem rerum & Animalium ſegmentis aut Teſſellis *Gemmarum* ingenioſe componunt. Et ſuccederet opus, ſi ſupremi Domini juſſa accederent, Facultaſque daretur ſeligendi, quæ ad *Vermiculata* ſive *Muſiva* iſtiuſmodi Opera requiruntur; etenim opaci Colores, quibus *Ars* maxime indiget, in *ſuccinis* occurrunt rariſſimi. Neque ſolum *Arte Toreutica*, ſed & *Pharmaceutica* ex *ſuccinis* Lucrum redigi poteſt; quum Agyrtæ circumforanei Adulteratis Oleis & Balſamis *ſuccinorum* tantum Argenti lucrentur. Præterea *Vernicis* & *ſuccino* magnus eſt uſus; atque *Laccæ* non cedit *ſuccinum*, ſi recte præparatur. Infectores quoque Pellium, *Ruſſi* imprimis ac *Judæi*, *ſuccinum* opere adhibent, ut & horum Ratione ex *ſuccino* Queſtus promitti queat.

An odd ſort of *Amber*, by M. Hevelius, n° 64. p. 2061

LXV. I lately received from one that liveth on the ſide of the *Baltick-ſea*, a piece of *Amber*, which is ſo ſoft, that I printed my Seal on it. It is *yellowiſh* as moſt *Amber* is, tranſparent and burning as other *Amber*, but its ſcent ſtronger, as if it were a kind of Glutinous *Bitumen*, and yet it hath been caſt up from the Sea this Year, and was found among other pieces. A very credible Perſon related at the ſame time, that he had been Maſter of a ſmall piece of *Amber*, ſoft on one ſide, and very hard on the other, wherein lay buried a Fly.

n. 66. p 2023

Succinum quod Sigillo cedit inter omnium rariſſima quæ apud nos reperiuntur, merito habetur, quippe dum vixi, ſi bina illa Fruſta, quæ penes me habeo, excipias, ne unquam quidem vel minimum Fruſtulum vidi, ut tale a multis Annis ſollicite quæſiverim. An unquam Fruſtulum, altera parte *Molle*, altera *duriſſimum*, poſſim impetrare, valde dubito.

LXVI. The

White Amber; *By* M. Kirby. n. 89. p. 4262 *Vid. Sup. Cap.* II. § XXIII.

LXVI. The chief Fiſher upon the *Inland poyſonous Sea* near *Dantzick*, informed me, that 2 or 3 Years ago fiſhing in this Sea, his Net brought up a conſiderable large piece of *white Amber*, which was a Rarity he preſented to one of the chief Fathers of the *Olives* Abby, to which this Sea belongs. Now ſince this Sea lies high, and about 3 *German Miles* diſtant from the Ocean; and ſince alſo the neighbouring Woods, that bear none but highly reſinous Trees, cannot be reaſonably ſaid to furniſh ſuch *Amber*, that Conjecture, which imports that *Amber* is a *Bituminous Fluid Subſtance*, hardned by the *Aqua aerial* Particles upon it, may receive ſome Confirmation from this Account.

The Electrical Power of Stones in relation to a Vegetable Roſin; *By Dr.* Liſter n 110. p 224

LXVII. Having occaſion in *July* 1674, to view certain Foſſils, which I had diſpoſed into divers Drawers in a Cabinet made of *Barbadoes Cedar*, I obſerved many of the ſtones in every Drawer, (and ſome were lapped up in Papers) to be thick covered over with a liquid Roſin, like *Venice Turpentine*; tho' after diligent ſearch, there appeared no Manner of Exudation in any part of the Cabinet.

Of the many ſorts of ſtones I there had, divers eſcaped, but not any of the *Hæmatites* kind; having therein *Manganes, Sciſtos, Botryedes, &c.* which were all deeply concerned, and amongſt perhaps 500 Pieces of the *Aſtroites* here and there one or two in an Apartment, and ſometimes more were ſeiſed, and the reſt dry; as it fares with People in the time of the Plague in one and the ſame Houſe. I further obſerved, that Stones of a ſoft and open Grain, as well as thoſe of a hard and poliſh'd ſuperficies, were concerned in a manner alike.

'Tis certain, that the whole Body of the *Turpentine* of the *Cedar-wood* was carried forth into the Air, and floating therein, was again condenſed into its own proper Form upon theſe ſtones. This makes it more than probable, that odoriferous Bodies emit and ſpend their very Subſtance. Thus *Camphir* is ſaid, if not well ſecured, totally to fly away. Again, it is hence Evident, that there is great Difference betwixt the Diſtillation of Vegetable Juices, and the Emiſſion of Effluviums, or this Natural Diſtillation: That really ſeparating and dividing the ſubſtance into different parts; but this carrying out the whole entirely and unaltered in its Nature.

A Catalogue of Electrical Rodies; *By* Dr. Rob. Plot. n 245 p. 384

LXVIII. Non ſolum *ſuccinum & Gagates* Allectant Corpuſcula, ſed & *Adamas, Sapphirus, Carbunculus, Iris* Gemma, *Opalus, Amethyſtus, Pſeudo-adamas, Briſtolienſis, Berillus & Chryſtallus :* Item *Hyacinthus, Granatus Bohemicus, Vitrum, & ex Vitro* ſive *Chryſtallo, Gemmæ Adulteratæ, Vitrum Antimonii & Saturni,* Omnes *Fluores ex Fodinis, Belemnites, Sulphur, Maſtix, Cera ſigillaris ex Lacca, Reſina Durior, Arſenicum* ſed imbecillius, & Cælo ſicco *Sal Gemma, Lapis ſpecularis, & Alumen Rupeum.*

Ambergreece a Vegetable Production, by communicated by R. Boyle, n. 97 p.6113.

LXIX. 1. The ſeveral Trials and Obſervations of my own about *Ambergreece* having long kept me from acquieſcing either in the vulgar Opinions, or thoſe of ſome learned Men concerning it; yet I confeſs, my Experiments did much leſs diſcover what it is, than the following Paper has done, in caſe we may ſafely and intirely give credit to its *Information*, and that it reach to all kinds of *Ambergreece*. And probably you will be invited to look upon this account, tho' not as compleat, yet as very ſincere, and on that ſcore credible if you conſider, that this was not written by a *Philoſopher* to broach a Paradox, or ſerve an Hypotheſis, but by a *Merchant* or *Factor* for his Superiors, to give them an Account of a Matter of Fact; and that this Paſſage is extant in an *Authentick Journal*, wherein the Affairs of the *Dutch* and *India Company* were by publick Order from time to time regiſter'd at their chief Colony *Batavia*, which was lately taken in a *Dutch Eaſt-Indian Prize*. And it appears by the Paper it ſelf, that the Relation was not looked upon as a doubtful thing, but as a thing from which a practical Way may be deduced to make this Diſcovery eaſily *Lucriferous* to the *Dutch Company*.

‘Ambergreece (ſays the Journaliſt, *Mar.* 1. 1672.) *is not the Scum or Excrement of the* Whale, &c. *but it iſſues out of the Root of a Tree, which Tree how far ſoever it ſtands on the Land, always ſhoots forth its Roots towards the Sea, ſeeking the Warmth of it, thereby to deliver the fatteſt Gum that comes out of it: Which Tree otherwiſe by its copious Fatneſs might be burnt and deſtroyed. Wherever that Fat Gum is ſhot into the Sea, it is ſo tough, that it is not eaſily broken from the Root, unleſs its own Weight, and the working of the warm* Sea *doth it, and ſo it floats on the* Sea.

‘ *There was found by a* Soldier $\frac{7}{8}$ *of a Pound, and by the Chief, Two Pieces weighing 5 Pounds. If you plant the Trees where the ſtream ſets to the ſhore, then the ſtream will caſt it up to a great Advantage.*

An animal Production, by Mr. *Rob. Tredway*, n. 232 p. 711.

2. An ignorant Fellow in *Jamaica*, about two Years ago, found 150 Pound Weight of *Ambergreece* daſh'd on the ſhoar, at a Place in theſe parts called *Ambergreece Point*, where the *Spaniards* come uſually once a Year to look for it. This vaſt Quantity was divided into two Parts; ſuppoſed by Rolling and Tumbling in the Sea. This Man tells me that 'tis produced from a Creature, as Honey or Silk. And I ſaw in ſundry places of this Body, the Beaks, Wings, and part of the Body of the Creature, which I preſerved ſome Time by me. He adds, That he has ſeen the Creatures alive, and believes they ſwarm as Bees, on the Sea ſhore, or in the Sea.

The Production of *Coral*, by S. P. Boccone, n. 99 p.6158

LXX. 1. *S. Boccone* having been preſent at the *Coral Fiſhing*, in the Channel of *Meſſina*, which ſeparates *Calabria* from *Sicily*, relates in a Letter of his, written on that Subject to Signior *Marchetti* at *Piſa*, that before the *Coral Fiſhers* drew their Nets out of the Water, he immerſed his Hand and Arm into the Sea, to feel whether the *Coral* was ſoft under the Water, before it was drawn up in the Air, and found it altogether hard, except the

Round End, which having been bruiſed with his Nails, he found it made up of 5 or 6 little Cells, full of a white and ſomewhat mucilaginous Liquor, reſembling that milky Juice, found in Summer in the long Cods of the Herb called *Fluvialis Piſtana Foliis Denticulatis*, ſpoken of by *Joh. Bauhinus*.

This *Corallin Juice* he calls *Leven*, becauſe having taſted it himſelf, as well as the Mariners did, they always found it of a ſharp and adſtringent Taſte, in ſuch pieces as came recently out of the Sea; thoſe that are dried loſing that part of the Taſte which is acrimonious, and retaining only that which is Adſtringent: Which Change of Taſte he affirms, to be made in about 6 Hours after the *Coral* hath been drawn up; in which Time alſo the ſaid *Leven*, that is encloſed in the Pores is dried, and hath changed its Colour. He inclines ſtrongly to the Opinion of thoſe who conceive, that the long Concoction of the *Ferment* fixes the parts, and produces the *red Colour*, eſpecially being near to the *hard Coral*, and the *red Vermillion*, which ſurrounds it.

By M. Guiſony. ib. p. 6159.

2. M *Guiſony* is of Opinion, that *Coral* is ſo far from being a Plant, that 'tis a meer *Mineral*, compoſed of much *Salt* and a little *Earth*; and that 'tis formed into that Subſtance by a *Precipitation* of divers *Salts*, that enſues upon the Encounter of the *Earth* with thoſe *Salts*; after the Manner of the known *Metallick Tree*, which in a very little Time is form'd, and increas'd by the Settling and Combination of *Mercury* and *Silver*, diſſolv'd in *Aqua Fortis*, and afterwards caſt into common Water; the Parts of this *Mineral* and *Metal* joyning themſelves one to another. Which thing alſo happens in ſome *ſubterraneous Grotto's*, where by a continual and long Fall of Water drops many ſorts of Figures, and amongſt them Shapes of little Trees are form'd. This Sentiment he confirms, by alledging, That he can ſhew a *Salt* of *Coral*, which, being caſt into Water, and there diſſolv'd, upon the Evaporation of that Water by a gentle Heat, is preſently coagulated, and converted into ſtore of ſmall Sticks, reſembling a little Foreſt.

Trochitæ &c. Entrochi deſcribed, *By* Dr. Liſter, n. 100. p. 6181.

LXXI. 1. The *Stones* figured like *Plants*, which *Agricola* calls *Trochitæ*, and the compound ones *Entrochi*; we in *Engliſh*, St. *Cutberd's Beads*, are, (like the *Lapides Judaici*) of an *opaque* and *dark coloured Spar*; tho' I have of them from ſome Parts of *England*, of a *white Spar* or *Cawke*, as our Miners call it. They all break like *Flint*, poliſhed and ſhining.

Vinegar as a *Menſtruum*, will corrode and diſſolve them (as well as all *Foſſiles*, of what *Figures* ſoever) provided they be broken into different ſmall *Grains*, and if the Bottom of the Veſſel hinder not, they will be moved from Place to Place by it.

The Figure of the *Trochitæ* is *Cylindrical*; the utmoſt *Round* or *Circle*, (we ſpeak of one ſingle Joint, which *Agricula* calls *Trochites*) is in general ſmooth, both the flat ſides are thick, drawn with fine and ſmall *Rays*, from a certain Hole in the Middle to the Circumference. Two, Three, or more of theſe *Trochitæ* joined together, make up that other Stone, which is called *Entro-*

chus

chos. The *Trochitæ*, or ſingle Joints, are ſo ſet together, that the Rays of Fig. 93. the one enter into the other Furrows, as in the *Sutures* of the *Skull.*

They are found very plentifully in the *Scars* at *Braughton* and *Stock*, little Villages in *Craven*. I never met with any much above two Inches about; others there are as ſmall as the ſmalleſt Pin, and of all *Magnitudes* betwixt thoſe Proportions. They are all broken Bodies; ſome ſhorter Pieces, ſome longer, and ſome of them indeed *Trochitæ*, that is, but ſingle Joints. I never found one entire piece much above 2 *Inches* long, and that very rarely too; in ſome of which long Pieces, I have reckoned above 30 Joints. And as they are all broken Bodies, ſo are they found dejected and lying confuſedly in the Rock, which in ſome Places, where they are to be had, is as hard as *Marble*, in other Places ſoft and ſhelly (as they call it) that is, rotten and periſhed with the Wet and Air. And though in ſome Places they are but ſprinkled here and there in the Rock, yet there are whole Beds of Rock of vaſt Extent, which are made up for the moſt part of theſe, and other figured *ſtones*, as *Bivalve*, *Serpentine*, *Turbinate*, *&c.* as at *Braughton*.

As to the *Injuries* they have received in their Removal from the natural Poſture if not Place of their Growth and Formation, they are manifeſt; for, beſides their being all *broken Bodies*, we find many of them depreſſed and cruſhed, as if the Joint of a hollow Cane ſhould be trod under Foot: Theſe Fig. 92. *Cruſhes* being alſo real *Cracks*, as of a Stone or Glaſs. Again, Theſe *Stones* conſiſting of many *Vertebræ* or Joints, they are many of them ſtrangely *diſlocated*; ſometimes two, three, or more of the Joints in a Piece are ſlipped out of Order, or Rank, and ſometimes a whole Series of Joints, as when a Pack of Crown Pieces leans obliquely upon a Table. Further, others I have, that are twiſted like a Cord; if this poſſibly may be reckoned among the *Injuries*. Laſtly, ſome have their Joints, indeed, even, and in File, but are yet ſtuffed with a Foreign Matter, as when *Bricks* are laid in *Mortar*.

There is great Variety as to the Thickneſs of the *Trochitæ* or ſingle Joints, ſome are ſo thin, that they are ſcarce the full of the *24th* part of an Inch; others are a full quarter of an Inch thick; of theſe latter I only found at *Stock*: Betwixt theſe Extreams there are joints of all Meaſures in divers Pieces, but in one and the ſame Piece, they are moſtly of an equal Thickneſs. And there are ſlender and ſmall *Entrochi*, or Pieces, which have as thick Joints as the biggeſt and faireſt Pieces.

There is alſo ſome Difference in the *ſeams*, or cloſing of the Joints. Some are but ſeemingly jointed; which appears by this, that if they be eaten down a while in diſtill'd *Vinegar*, the ſeeming *ſutures* will vaniſh, as in ſome I had out of *Staffordſhire*, from about *Biresford* upon the *Dove*: Others, and all here at *Braughton* and *Stock* are really jointed, and the Sutures indented; which Indentures being from the terminating of the Rays, they are more fair or large, according to the Difference of the Rays, but even, equal and regular.

We have ſaid that the utmoſt Circle is generally flat and ſmooth, yet are there many other Differences to be noted; very probably becauſe they are parts of different ſpecies.

1. Their Joints are of different Thickneſſes.

2. On ſome *Entrochi*, betwixt ſuture and ſuture, in the middle of each Joint, are certain Knots in a Circle; the Joints thus diſtinguiſhed are very deep and large, and are very frequent at *Stock*.

3. There are likewiſe of theſe with a Circle of Knots, which have many Knots beſides on each Joint, and look rugged.

4. Some with much thinner Joints, which yet have a Circle of Knots in the middle of each Joint; and this alſo looks as tho' it were all over knotted; and theſe are found at *Braughton* only, as far as I know.

5. As ſome have but one Circle of Knots, others are knotted all over the Joint, and rough; ſo are there ſome others, which have a Circle of larger Knots in the middle of each Joint, and a Circle of leſſer on each ſide, cloſe adjoining to the Border or Verge of the *Suture*. This is huge pretty, and they are found at *Stock*.

6. Others betwixt *ſuture* and *ſuture*, in the middle of each Joint, riſe with a circular Edge.

7. A ſmooth *Entrochos* with a large or much riſen Edge on the middle of one of the Joints, and a much ſmaller on the middle of another Joint, and that alternatively.

8. The ſame alternate Difference, the Joints only much rounder and blunt, and here the Joints are viſibly one thicker than the other.

9. The ſame, with alternate Edges knotted.

10. A double Edge in the middle of every Joint; this makes the Joints look as tho' they were exceeding thin and numerous, but indeed they are not ſo.

11. A double Edge in the middle of every Joint, knotted by Intervals, or as it were, ſerrate Edges.

Some of the pieces of moſt, if not all, of the Differences of theſe *Entrochi*, are ramous, having leſs Branches deduced from the greater, and that with- *Fig.* 92. out Order. Theſe Branches are deep inſerted within the Stem, and by being ſeparated, leave great Holes in the ſides of it. The Rays in the Joints *Fig.* 93. of the Branches, run croſs to the Rays of the Stem. On thick Stems are ſometimes very ſmall Branches, but moſtly the bigger the Stem the thicker the Branches. Some of theſe Branches are branched again: Yet I find not any of them above one Inch entire, and yet adhering and inſerted into its Stock or Bole, and for the moſt part not above a Joint or two. The Branches are known from the Stem, by being a little crooked, and ſomething tapering or conic.

We meet but with few Pieces (beſides the Branches) that are not exactly Cylindrical, ſetting aſide the *Injuries* above mentioned. And amongſt thoſe few, ſome tapering at both Ends, and much ſwelled in the middle; others *Fig.* 94. figured like a kind of Fruit, or *Lapis Judaicus*, yet truly *Entrochi*, and jointed, notwithſtanding this ſhape: Upon a ſmall Stalk of two or three Joints is ſuddenly raiſed an oval Bottom, broken off alſo at both Ends.

Fig. 95. To theſe we ſhall add, what ſeems to have been *Summitates*, or *Faſtigia*; long and ſlender pieces with a little Button, hollow on the very Top; which Top ſeems not to have been divided or broken off from any thing elſe.

Theſe Hollows are ſometimes filled with Earth, and ſometimes another *Entrochos* is incloſed, like a pair of Screws, and which is, (as it were) Pith to the other.

Of theſe inward *Entrochi*, ſome I have which are tranſparent. Theſe Hollows or Piths are of different Bores, but moſt are round. And yet there are of them in great Plenty at *Stock*, whoſe Hollow in the middle is in the Fig. 91. elegant Faſhion of a *Cinquefoil*, and the Rays of the Joints of theſe *Entrochi*, are much deeper and fewer in Number, than of any other yet obſerved by me. Theſe alſo are ſmooth jointed. This is moſt ſurprizing, and I know not any Vegetable whoſe Pith is perforated in ſuch a Manner.

Laſtly, We, in theſe Rocks, find certain rude *ſtones*, of the Bigneſs of *Walnuts*, Fig. 96, 97, 98. which have many Impreſſions of *Trochitæ* upon them, as though they had been the Roots of them. And when theſe have been a little cleanſed in *Vinegar*, theſe Impreſſions appear more than caſual; for the Subſtance that covers them (if not the Stones themſelves) is Spar, and the Impreſſions are round Holes with Rays, like thoſe Holes which we ſaid above the Branches, made in the ſides of the Stock, when broken out from them. I have found ſome of them moſt elegantly figured, intire and compleat at *Stock*, amongſt very many others ſtrangely ſhattered and defaced. One is in the Faſhion of a *Pine-Apple* or *Cone*, with a hollow Bottom, about the half of an Inch deep, and as much over at the Bottom: On the very Top is the round Figure of an *Entrochos* broken off; round about the Bottom or Baſis are five ſingle Feet at equal Diſtances, in the Figure of Creſcents. The Stone is incruſtate, or made up of Angular Plates, *viz.* the Bottom is compoſed of 5 Plates, which we call Feet; the Middle of the Stone of 5 other Plates, all of a *ſexangular Figure*, and the Top, Stone. All other Plates are ſmooth on the out-ſide.

Another is much after the ſame pyramidal Faſhion; the Bottom convex, about one Inch and a quarter over, on the Top is the lively Impreſſion of an *Entrochos* broken off; or rather a *Trochites* yet remaining; round the Baſis are 5 double Points or Feet, at equal Diſtances, all broken off, and ſomewhat in the Figure of Creſcents. This Stone is alſo incruſtate, or cover'd with *ſexangular Plates*, which are rough.

Of theſe *figured Plates*, I find great variety in the Rocks, broken off, and heaped together in great confuſion, which yet manifeſtly belong to the above deſcrib'd *ſtones*. Some of the faireſt of them at *Braughton* and *Stock*, are *Pentagonous*, and as broad as my Thumb Nail, hollow on the ſide like a Diſh; Convex on the other ſide, where are certain eminent Knots, about the bigneſs of a ſmall *Pin's Head*, ſet in a kind of ſquare Order, This Plate is ſomewhat thin at the Edges and yet blunt. Others are *Pentagonous* and ſomewhat

what convex above, but not hollow underneath, and without theſe eminent Knots; the Edges as thin as of a Knife, and ſharp. Others of theſe *Pentagonous* Plates are convex on one ſide, and ſomewhat hollow on the other; thick edged; one of the 5 ſides only is indented; the indented ſide is ever the thinneſt, and the Stone is moſt ſlop'd towards that ſide. *Note*, that there are many amongſt theſe laſt indented ſorts of Plates, which are channelled the concave ſide, and otherwiſe notched. One of theſe *Pentagonous Plates* from *Wansford-bridge* in *Northamptonſhire*, has one of the 5 ſides thick indented; the *convex* part has in the middle a raiſed *Umbo*, like ſome ancient Shields, and round about the ſides a Liſt of ſmaller *Studds*, and ſome from *Bugthorp*, under the *Woolds* in *Yorkſhire*, are much like this.

The *ſexangular Plates* are ſmall, ſave here and there one. Some of them are a little hollow on the one ſide, and *convex* on the other, having the *convex* ſide moſt elegantly wrought with raiſed or emboſſed Work; that is, with an equilateral Triangle beſtriding each Corner, and a ſingle right Line in the midſt; or, if you will, Two Triangles one within another. Theſe we found at *Broughton Scar* only. Others, which are moſt common in theſe Rocks, are a little hollow on the one ſide, and *convex* on the other: They are for the moſt part ſmooth on the *convex* ſide or ſcabrous only, ſome are much thicker than others, ſome being as thick as broad, but moſt are Plate like; the ſides are very unequal, as in *Cryſtals*; ſometimes 5 broader ſides and one very ſmall; again, two ſides broad and 4 much narrower, and infinite other Differences as to the Inequality of ſides.

2. 'Tis ſtrange that theſe main *Stems*, ſhould be of equal bigneſs from the top to the bottom, and not at all tapering, if they be indeed the Bodies of *Rock plants*. There are found in *Maltha* certain Stones called St. *Paul*'s *Batoons*, which I ſuppoſe were originally a ſort of *Rock-plants*, like ſmall ſnagged Sticks, but without any Joints; the Trunks whereof diminiſh according to the Proportion of other Plants, after the putting forth of their *Branches*. Thoſe *Roots* which you have obſerved, are a good Argument, that theſe Stones were originally pieces of *Vegetables*. Who knows but there may be ſuch Bodies growing on the *ſubmarine Rocks* at this Day, and that the Fiſhers for *Coral* may find of them; tho' being of no uſe, they neglect and caſt them away. Certain it is, there is a ſort of *Coral* jointed.

By Mr. Ray, ib. p. 6190.

3. All the *Trochytæ* and *Entrochi*, deſcrib'd by Dr. *Liſter*, are found in *Mendip-Hills*, except that figured like a Fruit, and my Obſervations generally agree with his. But I may add, that I find even the Joints of ſome of thoſe *Entrochi*, which ſwell in the middle, to be of that Make: So that ſuch an *Entrochos* ſhews like a parcel of little Barrels, ſet one on the other.

By Mr. J. Beaumont, n. 129. p. 724.

Their *Hollows* are of all *Bigneſſes*, from a *central Point* to the taking up of more than a third part of the Stone. Some of theſe *Entrochi* are ſo *hollow*, that there is only a thin Shell left, ſmooth within and without: Others have only a thin Shell left, but with *Screws* within and without, and ſometimes both theſe are one entire piece, with ſeeming *Sutures*. Thoſe *Hollows* like a *Cinquefoil* ſeem moſt natural to the *Radix*, having 5 hollow Stirts or Feet iſſuing ſide-ways from it: And I find in ſome pieces of *Radix*'s, that a little furrow paſſes inwardly from each Foot to the Top of the Stone with a Ridge on the outſide of it. Beſides theſe, I have a new ſpecies of *Trochites* and *Entrochi*; which has 6 Inlets in the Hollow, as the latter has but 5; but with this Difference, that theſe Inlets terminate in Angles, ſo that it is a *ſexangular Hollow*, whereas the *Cinquefoil* Inlets are round as the Leaf is, and not pointed, tho' I have ſeen even of theſe with ſharp Angles.

The *Rays* ſhooting from a *Center*, muſt of neceſſity leave conſiderable wideneſſes betwixt them, as they paſs towards the circumference, according to the bigneſs thereof; to fill up thoſe wideneſſes, I find that in ſome, betwixt 2 *Rays* iſſuing from the *Center*, a third Ray riſes about half way on the *Stone* from the Center, and ſhoots to the Circumference; ſome have their *Rays* gently widening from the Center to the Circumference; ſome have a *Trunk* riſing from the Center, which grows forked towards the Circumference; ſometimes betwixt thoſe Forks, there riſes a little Ray near the Trunk where the Forks join, which ſhoots to the circumference; (but note that theſe Differences are ſcarce diſcernable where the *Rays* are fine, but with the help of a Glaſs:) Some again are *Ramous*, having a *Trunk* riſing from the Center, with 3, 4, or 5 Branches ſhooting to the Circumference, ſome are ſmooth half way on the Stone from the Center, and have a Circle of ſmall Rays near the Circumference; ſome are ſmooth without any *Rays*, theſe are commonly pretty thick, and are joined in an *Entrochos* after this manner: One *Trochite* a little within the outward Circle, in the upper and lower parts, where the *Rays* uſe to be, has round Inlets or Sockets, pretty deep, ſo that only a thin *Tympanum* hinders, but the *Trochite* would be hollow at this Wideneſs all thro'; and in the middle of this *Tympanum* there is a Hole, as in other *Trochites*, which is ſometimes round, ſometimes like a *Cinquefoil*: The *Trochites* that anſwer this on both ſides, have ſmooths Joints, (I cannot properly call them *Screws*, having no Ridges) which enter into theſe Sockets; thoſe Joints being hollow alſo, and ſo other *Trochites*, with Sockets come on upon thoſe again to make up the *Entrochos*. Some of theſe have both Sockets and Rays, ſome have a Socket on the one ſide, and Rays on the other without a Socket; ſome are all ſmooth, only a ſmall Ridge runs round them a little within the outward *Circle*, which enters into a ſmall furrow anſwering to it; ſome are all ſmooth and joined only *per harmoniam*, as Mr. *Liſter* calls it, ſome *Trochites* hold of an equal Thickneſs of ſubſtance from the *Center* to the *Circumference*; ſome are pretty thick in the *Circumference*, and grow thinner towards the Center, ſo that they have Concavities on both ſides, to which *Convexities* in other *Trochites* anſwer. Some hold of an equal thickneſs half way on the Stone from the outward *Circle*, and then grow concave toward the Center. I have alſo found ſome *Entrochi*, as well as *Trochites* of an oval Figure, and their Bore is alſo oval. Some *Trochites* of this kind have no *Rays*, but are joined together only by one Ridge, which paſſes directly along the middle of the Stone the long way, there being a Furrow in the other anſwering to it, theſe have alſo a ſmall ſpeck in the middle, making but a very little Impreſſion in the ſtone, and ſeldom paſſing thro' it, tho' I have of this ſort with indifferent Holes as the other *Trochites*, but ſuch are commonly pointed at the ends, and not carried out with an oval Round as the others. There are ſome ſingle Joints which are ſhaped with a *double Oval*; that is, the *Oval* in the upper Part of them ſtands clean contrary to the *Oval* in their lower part. In ſome again the *Ovals* do not ſtand ſo extremely oppoſite to each other, but only the *Oval* in the upper part of the *Trochite* ſeems a little wreſted from the direct Line of the *Oval* in the lower part, ſo that they ſtand bend-ways to each other, like a St. *Andrew*'s Croſs; there are *Entrochi* too made up after this manner; and I find moſt of the *Oval Entrochi* grow crooked and twiſted.

I have one perfect *Radix* without any Impreſſion of a *Trochite* on it; the Top of it, indeed is a little flat with a hole in it, but it is withal very ſmooth without the leaſt ſign of a Ray; yet I find another with the Rays there; At the middle of the broad end, there is another Hole juſt oppoſite to this. At the Ends of the 5 *Stirts* or *Feet*, where the *Hollows* ſhould ſhew themſelves, there grows after a very artificial manner, a pretty large Seam of the ſame Stone juſt over the middle of the *Hollow*, from the upper part of the ſtirt to the lower part of it, parting the *Hollow* in the middle, and covering about a 3d part of it, not that this *Seam* enters farther into the *Hollow* than the *Mouth* of it, ſo that the *Hollow* of each *Stirt* preſents it ſelf with 2 Eyes: Hence it appears, that thoſe *Stirts* or *Feet* were never longer than they are, and that no ſtone ever grew to them. Theſe *Fore ſeams* being very obnoxious to the leaſt Injury, were broken off from Dr. *Liſter*'s. *Fig.* 96. The Stone is compoſed of *Trigonal*, *Tetragonal*, *Pentagonal*, and *Hexagonal Plates*. The upper part of the *Conical* End is wrought round with 6 large *Hexagonal Plates*, and theſe reach half way the Stone, then follows a ſecond Round, made up of *Pentagonal Plates*, pretty large, and theſe reach almoſt to the broad Bottom, which is a little convex; the Bottom it ſelf and Feet contain *Plates* of all Makes, *Fig.* 97. but moſt of them are very ſmall. This *Stone* is in ſubſtance a whitiſh Opaque *Fluor*, of the ſame Nature with the *Trochites*, it has outwardly a ruſty Coat, and is blewiſh within like ſome *Sea-Skells*. When 'twas firſt found, 'twas full of a ſort of Aſh-colour'd griſty Clay, which is the evident material Cauſe of it, it being found in a Bed of the ſame.

I eaſily pick'd out the Clay with a Needle, ſo that 'tis now all hollow; the *ſhell-like* and *ſparry* Subſtance being ſcarce as thick as half a Crown. I have one ſexangular Plate, whoſe *convex Part* has on it a *Star* conſiſting of 6 emboſt Rays, which ſhoot from the Center directly to the middle part of the ſides betwixt the Angles, and betwixt every two Rays there grows a little *Stud*, after a very elegant manner.

I find the *Trochites* ſticking to *Rake-mold-ſtones*, and in the Crannies of Rocks, at all depths from the Graſs to 20 Fathom; and doubtleſs there are of them deeper: But I find them moſt plenteouſly in certain Beds of an aſh-coloured griſty Clay, and particularly at one Place within a Yard or 2 of the Graſs. *Fig.* 94. I found here a Fruit with them like a *Lapis Judaicus*, (though ſomewhat defac'd) if not a ſpecies thereof, it's about the bigneſs of an *Acorn*, with *Ridges* and *Furrows* running the long way; it differs from thoſe deſcribed by Dr. *Liſter*, being rather leſs in the middle than at the ends, and the *Ridges* not knotted or purl'd. It is in ſubſtance a whitiſh opaque *Spar*, like the *Trochites*, tho' (as Mr. *Liſter* ſays) ſome *Trochitas* are of a dark coloured

Spar; and I find ſome of a white cawky ſubſtance, and ſome have a *Tincture* of red; but theſe differences proceed from the *Clay* of which they are made; for tho' an aſh colour be the chief in it, yet there are ſome veins of red in it, ſome of white ſome of a light blew, ſome of a dark blew, *&c*; which cauſe theſe Varieties in the Stones. I find ſome *Trochites* and *Entrochi* ſhaped in a *Raw Clay*, before they have attained the Conſiſtency of a *Stone*, and theſe, if laid in the ſun, become light and ſpungy like a *Pumex*. I took up there a piece of another ſtrange *Stone*, of the like *ſparry ſubſtance*, it is about the bigneſs of a *Walnut*, hollow, and fill'd with the ſaid *Clay*, it ſomewhat reſembles a *Helmet*, the fore part of it is ſmooth, the upper part, which has a large Ridge in the middle is all wrought with little Rings, three at a place encircled within each other. The *Stone* call'd *Cornu Ammonis*, ſhap'd like a Ram's-Horn, is very frequent in this *Clay*; the largeſt I have is 7 Inches in length, 4 Inches in Compaſs at the broad End, and 2½ at the ſmall End; the Top being broken off. Tracing its Original, I find ſome of the firſt Buddings out of it about the Bigneſs of a young Cocks-ſpur, and very much like it: I have ſome in raw Clay, and one growing of a white cawky Stone. They generally become at laſt a whitiſh *Spar*, and ſome milk white as ſome of the *Trochites* are.

There are of all intermediate proportions betwixt theſe two, tho' very few of any bigneſs are to be found entire, but all broken and imperfect pieces. And I take the ſeeming *Summitates* of Mr. *Liſter* to be only little Eſſays of Nature towards the production of this *Stone*, the Alliance being evidently nearer than betwixt them and the *Trochites*. The *Texture* of theſe *Stones* is thus: Some have maſſy *Spar* in their inſides, which takes up three parts of the *ſtone*, then from the ſharp top there grow thin flat Cells, or ſmall pipes of *Spar*, ſet edgeways one cloſe to the other, all round the ſtone, which ſhoot towards the broad end, and appear outwardly like ſmall *Ridges* or *Seams*, and many of theſe *Pipes* running down thus after the *Stone*, ſhew their Hollows, ſome at one place of it, ſome at another, and ſome not till they come to the Broad End: And this is the Texture of the great Stone, which has Rings alſo, tho' ſomewhat defaced, running round it, tending likewiſe in their Growth towards the broad end as in a *Ram's Horn*. Moſt of the leſſer *ſtones* have very little *maſſy Spar* within them, and ſome have none, but appear ſomewhat hollow at the broad End, with *Cells* coming down inwardly from the top of the ſtone, reſembling thoſe in the *Flowers* of *Coral*, which terminate its *branches*, and doubtleſs if taken from their Beds in a ſeaſonable time, would yield the like *milky-juice*; for I find in the Cells of ſome broken pieces of theſe *Stones* an evident *Concretion* of ſuch a milky Juice. And I may here acquaint you, that I have a piece of *branchy ſpar*, which I found at a Mine on theſe Hills, growing like *Coral*, and terminated with *Buttons* or *Flowers* like it. I find very few of the leſſer *Cornua Ammonis*, whoſe Cells do any way appear or ſhew their Hollows outwardly, as in the great ſtone, whoſe ourward ſurface is wholly made up (as I ſaid) of thoſe Cells, or thin flat Pipes, ſet cloſe the one to the other, many of which ſhew their *Hollows* at ſeveral Places in the ſtone, whereas the Cells in the ſmaller ones appear only inwardly, having one Coat outwardly which covers them all, and this Coat in ſome is ſmooth; in others it is all wrought with little Rings like the *Helmet-ſtone* before mentioned; and ſome out-ſides have Ridges or Rings round them as a Ram's horn.

Theſe Stones generally move in Vinegar, Juice of Limons, *&c.* ſending forth Bubbles, as I find *Cawk* will very freely, and moſt of our *Mineral-Stones.* This Motion ſeems to proceed from the Conteſt betwixt the *Acid Spirit* of *Vinegar* and the *Mineral Salt*; ſo that the Spirits by Fermentation breaking forth under the Stone produce that effect.

4. After diligent ſearch I have at laſt found a Mine, where well near all the *Entrochi,* (ſo called hitherto) or bodies of *Rock-Plants,* grew tapering and Ramous, ſome of them having Branches iſſuing from them near two Inches in length, and other ſmall Branches iſſuing from thoſe, and upon a nearer ſearch I diſcovered an entire Plant, though ſmall, growing up after the ſide of a Stone. I found alſo, that all the clifts in ſome Mines are made up of theſe *Stone Plants*; whereof ſome as appears, were converted into the nature of thoſe Limeſtone Rocks, whilſt they were in their firſt tender Growth; others being become *Spar* compoſe Rocks of that ſubſtance. Ib. p. 772 Fig. 100.

Conſidering that all the Clifts for a very large circumference in ſome places are made up of theſe Plants, we may truly ſay, that there have been, and are whole Fields or Forreſts of theſe in the Earth, as there are of *Coral* in the *Red-Sea.* In the *Courſes,* (or *Loads* as ſome call them) betwixt the Clifts I find of theſe *Plants* growing up in the Griſty Clay, mentioned above, being rooted on the *Rake-mold Stones*; many of them being above a foot in height, and about the bigneſs of the Stem of a Tobacco Pipe: All I have yet ſeen of this length, are either Raw Clay; or of the Conſiſtency of a *Lime-ſtone,* and ſome of them have outwardly evident beginnings of *Circles* and *Sutures.* The ſmall *Plant* which is entire, and the *Branched bodies* of many others, have attained their full term of Growth; being become perfect *Spar.* If theſe had ever a height anſwerable to their bigneſs, (ſome of them being near three Inches about,) they muſt have been much higher than thoſe before mentioned. The Branches are all joynted, and have the ſame Bore with the Trunks, and are terminated with round and blunt Joynts, but very ſmall. I find the Bores or Hollows of ſuch as are found to be commonly fill'd with a Milky Crudled Subſtance, which probably in their time of Growth was Fluid, like that in *Coral.* As it cannot be doubted but many of theſe *Plants* grow on thoſe admirable *Radixes* of which we have given an account, and whereof I have at preſent ſome pieces which have a *Cinquefoil Bore* on the top, others with the Impreſſions of *Oval* Joynts there, and many other differences; ſo I am now fully ſatisfy'd that many of them grow from *Plain Roots,* that is from *Plain Spar,* or *Lime-ſtone* without any ſuch Figure as the entire Plant does, and many other Trunks which I have noted.

Theſe *Plants* do not always grow up with one Trunk or Body; but ſometimes 5 or 6 Sprouts, near of an equal bigneſs, ſhoot up together from the ſame Root; as it uſually happens with *Coral.* I have met with ſome of them which have only four Inlets in their Hollows, and others with ſeven.

Some have a *Circular Edge* on every other Joynt, the Intermittent Joynt being ſmooth without Edge or Knot. Some Trunks have Circular Edges on the middle of every Joynt, but ſo that the Firſt and Fifth Edges are the higheſt; the Second and Fourth the loweſt; the Third is higher than the latter, and lower than the former, the Joynts themſelves being great and ſmall accordingly, and this order holds all along the Plant. Some Trunks have Edges according to the ſame order, only the Edges on the ſecond and fourth Joynts are round and blunt, the other three being ſharp; ſome have Edges after the ſame order, which are all round and blunt. There are ſome Trunks wrought after the ſame manner, only the Firſt and Fifth Joynts have a Circle of Knots round them, the other Three have Edges: Some Trunks have no Circles, nor Knots, but are only a little Scabrous like the *Plates* which compoſe ſome Roots. But notwithſtanding theſe Diverſities of *Figures*, the Texture of their ſubſtance appears to be wholly the ſame: And therefore ſince we find no Qualities either by the ſmell or taſte which manifeſt any Specifical Diſtinction, it may perhaps, be as hard to make them out to be Diſtinct Species, as to ſhew a Specifical difference betwixt ſeveral Snow Bloſſoms.

Fig. 101. The Reaſon of that ſtrange Diſorder which theſe *Plants* uſually lie in, and of thoſe Injuries they have received, perhaps may be this; whilſt they were growing, the Clay wherein they grew was ſoft as a Quagmire, theſe probably requiring ſuch a ſubſtance to ſupport their Growth, as *Coral* does Sea Water: Afterwards as they began to ſettle to a ſtony Conſiſtency, and as part of the Clay became of a Rocky Nature, the whole Maſs ſunk from its Poſition, and the Moiſture paſſing away made ſome Concavities, waſhing down ſome broken pieces of thoſe Stones with it; and lumps of Clay and other Stones, falling down through thoſe Crannies, added to their Confuſion, being very apt to be diſordered by the leaſt Concuſſion, either whilſt they were in their firſt Growth, or after they were become *Spar*, their Joynts being very tenderly ſet together; and hence theſe Stones are generally found in *Leirey* places (as they call it) that is, *Cavernous*.

Theſe Rock Plants begin their Growth from the fineſt Parts of Clay, being commonly White, Soft, and ſmooth at firſt, and by degrees come to have Ridges, Knots, and Sutures, as they grow towards a Stony, and ſo to a Sparry Nature.

The Pith continues ſtill ſoft and white, as the whole is at firſt, and it is continually refreſh'd by the *Mineral* ſteams and moiſture, which have free acceſs to it through the 5 hollow Stirts or Feet, in the *Figur'd Roots*, or through the Maſs of Clay which commonly lies under the *Plain Roots*. Nor can it be ſaid but thoſe *Stone-Plants* have true Life and Growth; for ſince in the Curioſity of their make they may contend with the greateſt part of the *Vegetable* Kingdom, and are ſhap'd like them, having inward Pith or Sap, and likewiſe Joints and Runnings in their Grit, and ſometimes Cells, which may very well ſupply the Place of Veins and Fibres, I know not why they may not be allowed as proper a *Vegetation* as any Plant whatſoever.

Vid. Sup. §. LXX. 2. And though a Salt of *Coral* after Diſſolution, will upon Coagulation ſhoot into a little Grove of Plants, as it were, reſembling the Growth of *Coral*, yet this cannot diſprove its *Vegetation*; for it's well known, that all Plants may be ſo prepared, that from their Aſhes they will riſe again in their proper Species after ſuch a manner.

But I am enclined to the Opinion, that theſe *Rock Plants* are *Lapides ſui generis*, n 150 p 276. and not *Parts* of *Plants* or *Animals Petrefied.* Indeed the *Figured Roots* on which theſe *Rock Plants* ſometimes grow (as appears by the Impreſſion of *Rays* on the Tops of ſome anſwering to thoſe in the Joynts of the Plants, and by the impreſſion of *Oval Joynts* there) may give us ſome Suſpicion that they once belong to an *Animal*, whether it were a ſpecies of the *Stella Arboreſcens*, or ſome other: But the Trunks of theſe Stone *Plants* cannot be looked upon as Parts of *Animals*, with the leaſt ſhew of Probability. And I think them almoſt as hardly Reducible to any known Species of *Vegetables*; conſidering that, beſides the *Bores* of ſome of theſe with 4, 5, 6, and 7, Inlets in them, and beſides their admirably diverſified Joyntings, ſcarce either of them to be match'd in any *Vegetable*, I have by me above 20, if not 30, Species of theſe *Rock Plants*, differing outwardly from each other in their *Joynts*, *Knots* and *Sutures*, all obſerving a wonderful Regularity, and not one of them to be parallel'd by any *Vegetable* that I know of in Nature. And we cannot well imagine, how ſo many Species, diffuſed through many parts of the whole Earth, ſhould all happen to be loſt together. So that upon the whole, this ſeems to me a conſiderable objection, againſt thoſe who maintain that all Figured Stones in the Earth, are Petrefactions of Plants or Animals, to which Opinion *Steno*, in his Diſſertation concerning Solids naturally contained within Solids, adheres.

LXXII. 1. I have procured a good quantity of the *Aſtroites* from *Bugthorp* *The Aſtroites,* and *Leppington* at the Foot of the *Yorkſhire Woolds*: At the former place I have *By Dr.* Liſter. ſeen them dug out of a certain Blew Clay on the Banks of a ſmall Rivu- n. 112. p. 274. let, betwixt the Town and the foot of the *Woolds.* There are plenty of them *Fig.* 103. waſhed into the Brook; but the moſt fair and ſolid are thoſe we get out of the Clay.

The Matter and Subſtance of theſe Stones, if broken, is *Flint-like*, of a dark ſhining Politure; but much ſofter, and eaſily corroded by an *Acid Menſtruum*. *Vinegar* indeed makes them creep; but a ſtronger Spirit, as of *Nitre* toſſes them. I doubt not, but they will readily Calcine, as the *Bellemnites* to a very ſtrong and white Lime.

Theſe Stones (as we now find them) are all *Fragments*; either one ſingle Joynt, or 2, 3, or more Joynts ſet together, making a *Pentagonous* or five ſided, Column. I have not yet had any Piece much above one Inch long, which conſiſted of 18 Joynts; but I have ſeen one Piece, ſomewhat ſhorter than the former, which had 25 *Joynts*. Theſe laſt thin-joynted pieces are quite of a different make, as to all Circumſtances, from the other.

Every Joynt conſiſts of 5 Angles, which are either drawn out and ſharp, and conſequently the ſides of Pieces made up of ſuch Joynts are deep Channell'd; (and this is the condition of ſome of the Thick Joynted pieces, as well as of all the Thin Joynted ones; or the Angles are blunt and round;

and the ſides Plain or very little hollowed. There are as big, and as ſmall pieces of this ſort, as of any other more Sharp-angled.

Where the Joints are thin or deep, they are ſo equally throughout the whole piece; yet are there ſome, but very few pieces, which conſiſt of Joints of unequal thickneſs. Many of the Thick-jointed pieces have certain Joints a thought Broader, or a very little ſtanding out at the Angles, and thereby the Joints are diſtinguiſh'd into certain Conjugations of 2, 3, or more Joints: And theſe Conjugations are very obſervable in the Thin-jointed Stones, and are marked out with a ſet of Wyers.

The thickeſt piece, which hath yet come to my Hands, is not above one Inch and a half about, and thoſe very rare too: From which ſize to that of a ſmall Pin, I have all the Intermediare proportions; and theſe ſo exceeding ſmall pieces are as exactly ſhaped as the greateſt. Moſt pieces, if not all, of any conſiderable length, are not ſtreight, but viſibly bent and inclining.

All the pieces, of any ſort, are much of an equal thickneſs or but little tapering; yet one of the ends, by reaſon of a Top-Joint, is viſibly the thickeſt.

This Top-Joint hath 5 Blunt Angles, and is not Hatched or Engraven, or but very faintly, on the outſide. Every Joint elſe of a piece (ſave the Top-Joint) is an *Intaglia*, and deeply Engraven on both ſides alike; and will accordingly ſerve for a Seal. The middle of each Angle is hollow, and the Edges of the Angles are thick furrowed: The Terminations of theſe Hatchings are the indented Sutures by which the Joints are ſet together; the Ridges of one Joint being alternately let into the Furrows of the other next it. The Hatchings of the flat-ſided Pieces are in Circular Lines; but of the other two Species they are ſtraight Lines or near the matter.

Fig. 104. In the very Center of the 5 Angles, is a ſmall Hole, conſpicuous for moſt Joints. Note alſo, that in the middle of each Joint, betwixt Angle and Angle, in the very Suture, is another ſuch like ſmall Pin hole very Apparent, if the Stones be firſt well ſcoured.

In the deep jointed Pieces, juſt under the Top-joint above deſcribed, the *Fig.* 105. Veſtigia of certain Wyers rather than Branches; and ſometimes 2, 3, or more of the Joints of the Wyers yet adhereing. Theſe Wyers are ever 5 in number, *viz.* One in the middle or hollow part betwixt Angle and Angle. Again in thin jointed Pieces there are 5 of theſe Wyers, or a ſet of them inſerted into every Conjugation of Joints; ſo that it were ſome Repreſentation of the thing, to imagine the Stalk of *Aſperula* or *Equiſetum*: Alſo I have ſeen, but that very rarely, (not in one piece among 500) a ſet of Wyers in the middle a deep jointed piece. One thin-jointed piece I have by me, where a *Wyer* of 20 Joints and upwards (and how much longer they may be I know not) lies double within the hollow ſide, and by that accident was preſerved in its natural *Fig.* 106. place. Further, ſome Lumps of *Quarry* I have from the Place abovenamed, where the Wyers, as well as the Stones themſelves, are ſeen in long pieces. It is no wonder, that theſe Wyers are knock'd off, and but very rarely found adhering to the Stones they belong to, being very ſmall and ſlender, of a round

Figure and ſmooth-jointed, being ſet together *per Harmoniam*, aud not Indented Sutures. Nothing that I can think of, is ſo like theſe Wyers, as the *Antennæ* of *Lobſters*. Laſtly ſome of theſe Wyers are knotted, and others of them fairly ſubdivided or branched.

By Mr. Ray. ib. p. 273.

2. If you can allow the *Trochites* and *Entrochi* to have been Fragments of *Rock-plants*, I ſee not why you ſhould make any difficulty of admitting theſe to have been ſo too; the ſeveral *Internodia* being alike thin in both, and the *Commiſſures* not much different; only the external Figure doth not Correſpond. The Wyers ſpringing out of the Furrows or Concave Angles of ſome of the *Internodia*, and encircling the Stalk like the Leaves of *Aſperula* or *Equiſetum* ſeems to me to Argue theſe Bodies to belong to the *Genus* of *Vegetables*; no leſs than *Coral*, *Coralline*, and the ſeveral ſorts of *Pori*, ſome of which are alſo Jointed: But no *Vegetable* either of Land or Sea, that I know of, hath ſuch frequent Joints and ſhort or thin *Internodia*, and ſo they are things of their own kind, whoſe Species is, for ought we know, Loſt. If they were *Vegetables*, I gueſs they were never ſoft, but grew upon the Rocks like *Coral*, and the other Stone Plants, juſt as they are.

The Leaves of ſome ſorts of *Equiſetum* are *Jointed*, as well as the Stalk: Elſe I know no Plant that hath Jointed Leaves, except ſome ſorts of *Ruſh-graſs*.

I have found on the Banks of the River *Tanar* in *Piedmont*, plenty of the *Fragments* of the ſtalks of *Equiſetum* perfectly *Petrefied*, with little or no Increaſe of Bulk, ſo exactly like the Plant, that all the *Striæ*, did all along clearly appear. The colour of theſe Petrefied Stalks was white.

Lapides Judaici; *By Dr.* Liſter. n. 110. p. 224. *Fig.* 107

LXXIII. We have plenty of Stones called *Dactyli Idæi* and *Lapides Judaici* (for *kind*) in the Stone Quarries at *Newton* near *Hemeſley* and at *Hellingley* by *Malton*. There is ſome Variety in the Figure of them; but the moſt common one in theſe Rocks is after the faſhion of *Date ſtone*, round and long about an Inch, and ſometimes longer. They are a little ſwell'd in the middle, and narrower towards each end: They are Channelled the length way, and upon the Ridge knotted or purled all over with ſmall Knots, ſet in a *Quincunx order*. The inward ſubſtance is a white Opaque *Sparr* and breaks ſmooth like a *Fint*, not at all hollow in the middle, as are the *Belemnites*.

Vertues of the Oſtracites; *By Dr.* Cay n. 250. p. 81.

LXXIV. 1. Dr. *Home* of *Berwick* tells me that he never uſed the *Oſtracites* to any that he knew to be troubled with a *Confirmed Stone* (being perſuaded that no Medicine can break a large Stone) but only to ſuch as were afflicted with *Gravel* or *ſmall Stones*, that ſome of his Patients were cured without Evacuating any *Gravel* or *Stones* at all, that others Evacuated both: That it never does its work ſuddenly, (being not remarkably *Diuretick*) but that it rather *diſſolved* the *little Stones* than forced them. That none that he ever gave this Medicine to, however grievouſly and frequently afflicted before, have ever been troubled with *Nephritick Pains* ſince; that his manner of giving it, is in fine Powder mixed with about a third part of *Flores C ammeli*. Doſe from *Half a Dram* to *one Dram* in White Wine, that the greateſt

Doſe is often apt to offend and Nauſeate the Stomach; that he once gave it alone, with a weak Infuſion of *Chamomil Flowers* in White Wine after it, but this did not ſo well.

I can ſay little of my own Knowledge of this Medicine, having had it but a ſhort while, and not uſed it yet to any but one Gentlewoman, whoſe frequent and violent Fits of the *Gravel*, made her lead a Life uneaſy enough. I gave her this Medicine mixt with powdred *Semina Saxifrag.* cannot ſay, that ſince ſhe uſed this Medicine ſhe never had any returns of her Pains, but ſhe neither has them ſo violent, nor ſo frequently; and whenever ſhe is threatned with them, ſhe moſt certainly finds Eaſe by that time ſhe has taken 3 Doſes of her Powder. And ſhe has, ſince the uſe of this Medicine, voided a great many ſmall Stones. But the Reaſon perhaps why ſhe is ſtill threatned with the return of her *Nephritick Pains*, is, that ſhe has never follow'd her Medicine throughly, but upon the third Doſe, finding ſuch certain Eaſe, ſhe gives it over, till a new Fit forces her to uſe it again.

I take this Shell to be what Dr. *Liſter* calls *Oſtracites Maximus Rugoſus & Aſper*. It burns to a Lime as other Shells do, and as the *Selenites* (tho' weakly) does. It yields no *Volatile* Salt, tho' I tryed it in a naked Fire; nor does common *Oyſter* Shells, freſh taken and uſed, afford above half a Scruple of a Liquor ſomewhat moderately *Urinous*, from 4 Ounces of Shells. And it may be, if they were long dryed and expoſed to the Weather, they would loſe even that, and yield no more *Volatile* Salt than the *Oſtracites*. I confeſs I was ſomewhat ſurpriz'd at this matter; ſince there are who ſay, that even the other Shells, that are commonly call'd Petrefy'd, yield a *Volatile* Salt: and I had my ſelf from the Shells of *Cruſtaceous Fiſhes*, (particularly of *Lobſters*) a *Volatile* Salt and *Fætid Oyl* in no inconſiderable Quantity, even in a *Sand Furnace*. But theſe ſort of Shells differ from other Shells (as Dr. *Liſter* has exactly obſerv'd) in this too, *Quod in his Umbo ad Cardinem leviter Roſtratus eſt, qui tamen in* Oſtreis *paulum aliter eſt*. They differ too in their *Specifick Gravity*, theſe being more Ponderous than common *Oyſter-ſhells*, and ſomewhat near the *Specifick Gravity* of the *Selenites*. But indeed they differ one from another in *Gravity*, as well as from other *ſhells*, as they partake more or leſs of a *Tophaceous* ſubſtance that Coats many of them on the inſide, and which perhaps may be ſomewhat a kin to the *Selenites*. I have obſerv'd ſome ſuch differences among the *Cornua Ammonis*, having had one or two ſmall ones from our Coal-Pits here, that had a conſiderable Mixture of the *Pyrites*; whereas theſe that are found about *Whitby*, approach, I think, more to the Nature of the *Alum-ſtone*; and perhaps the *Cornua Ammonis* of the Ancients were found in Beds of ſomewhat yet more Valuable, ſince *Pliny* ſays they were of a Golden colour, and were reckoned *inter Sacratiſſimas* Æthiopiæ *Gemmas*. I know *Agricola De Ortu & Cauſis Subterran. Lib.* 4. accounts for this Golden Colour after another manner: *Cornua Ammonis, inquit, ſucco* Aluminis *infecta* Aurei Coloris *fiunt*. And I am ready enough to think, that there is ſome Truth not only in this Obſervation, but in what he immediately adds; *Idem inquit, & aliis quibuſdam Lapidibus accidit*: For I cannot but attribute the extraordinary Appearance of Colours

in the *Peacock Tail Coal*, to its being infected with the *Succus Aluminis*, having ſeen ſome Pieces of this pretty ſort of Coal ſhoot into true and genuine *Alum*.

I ſhall only add concerning theſe *ſhells* that if they be *Real ſhells*, their being found in ſuch different Parts of the World, and at ſuch great diſtance from any Sea, may ſerve for a fair and convincing Argument of the Univerſality of the *Deluge*. And if they be not *ſhells*, but only Stones form'd by (what ſome People call) Fanciful and Sporting Nature, we may at leaſt conclude thus much from it, That ſince even theſe *Luſus Naturæ*, theſe Freaks, and Random Strokes of Nature, have not only a Beauty, but a real uſe, nothing in Nature is made in vain: And that many other *Foſſils* that we now contemn as Toyes and Trifles, fit only for furniſhing out a *Muſæum*, may have other remarkable Virtues, that may in time bring even them to be taken notice of, and valu'd, as well as the long neglected and deſpiſed *Oſtracites*.

2. The *Golden Colour* is from its being a *Pyrites*, that is Iron Stone. Again, all the *Conchitæ* kind, but more particularly the *Belemnitæ* and *Lapides Judaici*, were known to the Ancients for *Specificks* in *Gravel*. *By Dr. Liſter. ib. p 85.*

LXXV. *Siliquaſtrum* (quantum nobis innotuit) toto genere Novus eſt idemque Rariſſimus, nec Ineſegans Lapis. *Siliquaſtrum* autem appellare placuit, quod Siliquæ Lupini vel alterius cujuſdam Leguminis, Valvulum alterum (Cavitate tamen Repleta) non parum referat. *Siliquaſtri* Notæ Genericæ ſunt, quod ſit *Lapis figura plereque ad* Siliquæ Valvulum (*Sublato Concavo*) *accedenti*; *ex parte altera ſemper* Convexior; *&* (*ſi* Marmoris *inſtar fortuito expolites excipias*) *minute admodum Rigoſus*, *ſeu*, ut explicatius loquar, *Crebro & Eleganter Malleolatus*: *Facie quaſi Oleo Obductus*, *Reſplendenti*: *Textura ſi comminuitur* Belemnitis *fere ad inſtar Striata*. Hujus *Lapidis* plures dantur Varietates quarum præcipuas ſolùm modò nunc vacat recenſere. *Several Regularly* Figur'd Stones; *By* Mr. Edw. Lhwyd n. 200. p 748

1. *Siliquaſtrum* ad *Phaſeoli* Valvulum quodammodo accedens; ſeu *Siliquaſtrum Phaſeolatum* Figuram Titulus indicat; Magnitudinem quod attinet, *Seſcunciali* eſt Longitudine, *Dimidium Unciæ* Latum, vix *Quadrantem* craſſum. Quoad Peripheriam, aliud Latus quodammodo falcatum eſt, aliud (quod etiam magis acclive eſt) Rectum: Extremum alterum linea Obliqua cum Duobus Angulis clauſum; alterum non item. Ex parte prona ſuperficies rectilineis Striata eſt, cæterum leviter Rugoſa; & color *Anthracinus*, niſi quod ad utrumque Extremum, paululum vireſcat. Ex parte ſupina, Accretione quadam lapidea fœdatur, Coloris *Rubiginoſi*. inveni in Lapicidina *Witneienſi*, ſeptimo ab urbe *Oxon*. Lapide; ſed Rariſſime occurrit. Triplo aut Quadruplo minores aliquot, in quibuſdam a jam deſcripto differentes, habeo, e fodina *Stunsfeldenſi*, in hac Provincia. *Fig.* 108

2. *Siliquaſtrum Lupini*, Siliquam nonnihil referens; ſeu veniam dabis ſic loqui, *Siliquaſtrum lupinatum*. *Phaſeolato* ſubinde Brevior eſt, at ſemper Latior; Colore incerto, ſed ut plurimum a Prona parte *Nigro*, vel ad *Nigredinem* accedenti; a ſupina *Rubiginoſo*. Sed & utrinque variat quoad Colorem & Superficiem. A parte Gibboſa Lineolis Albis & Maculis neſcio quibus diſtinctum vidimus; quod & *Buſoniis* Lapidibus, & *Gloſſopetris* quibuſcunque *Fig.* 109.

aliquando accidit. Sed & inveni unum aut alterum cui a parte averſâ neſcio quid Appendicis adnaſceretur; in qua Virgulæ aliquot Tranſverſæ conſpiciatur, quaſi amiſſi cujuſdam ignoti Veſtigia. Differt hic Lapis a præcedente præcipue, quod ſit Latior, magiſque Rectus, a neutro latere Falcatus. In *Anglia* Mediterranea non admodum Rarus eſt hic Lapis. Vidimus in *Latomia Garvordienſi* in *Bercheria*, *Witneiæ* & *Charltoniæ* apud *Oxonienſes*, ad Pagum *Rance* in Comitatu *Northamptoniæ*, *Honey-comb Laſh* apud *Waltonienſes*, *&c.*

Dantur etiam in hoc Genere Lapides, quos *Piſi vulgaris* & *Viciæ Siliquas* æmulari dixeris.

Fig. 110. 3. *Siliquaſtrum Minus Triangulum*; ſeu *Minus, Concha ad inſtar Roſtellatum*: Colore & Superficie cum reliquis convenit; at *Tellinam* aliquam, vel (mavis) *Concham parvam Anglicanam Liſteri*, magis refert quam *Siliquam*. Verum ex Facie, cum Externa tum Interiori, *Siliquaſtrum* ſe prodit. *Stunſeldiæ* habuimus in Agro *Oxonienſi*.

Fig. 111. 4. *Siliquaſtrum* Oſſiculum e capite *Aſſelli Minoris* referens.

Fig. 112. 5. *Siliquaſtro congener Punctularia Gibboſa*, quandoque *Tortilis*, ſuperficie *Marmorea*: ſeu *Siliquaſtrum Gibboſum*, *Marmoreum*, argute admodum plereque *Punctulatum*. Superioribus magis Terſum & Expolitum eſt hoc *Siliquaſtrum*: ex Prona parte nunc magis, nunc minus *Gibboſum*; & Colore ut plurimum *Nigricanti*, alias *Subviridi*, *Exalbido*, *&c.* Ex parte Averſa ſeu Interiori, neſcio qua Oſſea Appendice munitur, Coloris *Nigri* vel *Rubeſcentis*, ſed hoc in pleriſque deſideratur. Utrinque in Mucronem magis Obtuſum deſinit quam priora. In multis quæ videre contigit Exemplaribus, pars *Gibboſa* Soli obverſa, minutula admodum & creberrima oſtendit *Punctula*. Paſſim Occurrit in Comitatu *Bercheriano* & *Oxonienſi*. Inveni in Lapicidinis ad pagos *Marcham Garvord* & *Stunsfield*.

Fig. 113. 6. Ejuſdem Lapidis major Varietas.

Fig. 114. 7. *Siliquaſtro accedens Ricinus*; ſeu *Siliquaſtrum Minimum inſtar Seminis Phaſeoli*, *Ricinus Lapis Siliquaſtrum* eſt omnium, quotquot hactenus videre contigit, Minimum; quod *Ricini* Herbæ, vel etiam *Phaſeoli* cujuſdam Minoris Semen quadantenus exprimat. Superne ſcaber eſt, plane ut *Siliquaſtra* proprie ſic dicta; Colore aut *Fuſco* aut *Atro nitenti*. Infra vero Decolor eſt, & informis. *Witneiæ* inveni, inſtar *Scarabæi Atro nitentes*; *Stunsfeldiæ* autem, & ex *Atro-nitentes*, & *Fuſcos*.

Conjicio quod hos *Lapides* quos nos *Siliquaſtra* diximus, Poſteri ad minimum (ſi non hujus ſeculi Philoſophi) *Piſcium Dentes* & *Oſſicula*, tuto appellaverint Certe quod ad *Siliquaſtrum Minus Triangulum* attinet, vidimus aliquot ſpecimina, *Oſſiculis* iſtis vulgo notis ex *Aſellorum* Capitibus non parum conſimilia.

8. *Bufonites Majuſculus Atro rubens inſtar Capſulæ Glandis Quercinæ.* Colore
Fig. 115. eſt undiquaque ex *Atro-ſubrubente*; quoad cætera omnino convenit cum Figura *Boetii*. Inveni in Lapicidina *Faringdonenſi* apud *Bercherianos*; ſed rarius occurrit.

Fig. 116. 9. *Bufonites Medius Retularis* Alveolo utrinque donatus. Color in ambitu ſubpallidus eſt; Alveolus ab utraque parte Rubiginoſus. Cum priore habuimus.

10. *Bufonites Medius Orbiculatus*, ſeu *Bufonites vulgatior Anglicus*. *Majuſculo* Atro rubenti triplo aut quadruplo minor eſt. Colore inſigniter variat; alias *Anthracino*, alias *Fuſco* ſive *Hepatico*, alias alio: Sed & nonnunquam *Cæruleis* maculis, & lineolis notatum vidimus. Unicum habeo craſſiuſculum, & cæteris minus depreſſum, colore Pallido aut Exalbido; *Atro* limbo aut Faſciola Fimbriatum. Fig. 117.

In Latomiis & ſalubetis *Angliæ Mediterraneæ*, paſſim obviam habuimus: at Specimen noviſſime dictum, in Lapicidina *Faringdonenſi*. Paſſim inveniuntur & minores & minimi Orbiculati, & Forma quaſi in plano Ovata.

11. *Bufonites minimus a convexiori parte rugoſus*. In Agro *Gloceſtrenſi* & *Oxonienſi* cum reliquis, ſed rarius. Fig. 118.

12. *Bufonites Minor, Trochili ad inſtar Faſtigiatus*, ſeu *Bufonites Trochylus* dictus Coloris eſt ex *Anthracino Subcærulei*, & Fimbria nigra donatus. E ſabuleto *Faringdonenſi*. Fig. 119.

13. *Bufonites Minimus Trochylo affinis Calyculo Striato longiuſculo donatus*. Caliculus ſtriatus Caſtanei Coloris eſt: Umbonis idem fere Color ac præcedentis. In Sabuleto *Faringdonenſi* aliquoties obſervavimus. Fig. 120.

14. *Bufonites Scaphoides extremo altero latiore*. In Lapicidinis *Marchamiæ* & *Garvordiæ* & ad *Faringdoniam* non admodum rarus. Fig. 121.

Omnes *Bufonites* ut id ſemel dicam, variant colore; at *Anglicani* ut plurimum ad nigrum Fuſcum, & Hepaticum accedunt. Hos Lapides *Angliæ*, ante hac inveniri non conſtat: Nam *Bufonites* D. *Plot in hiſtoria Oxonienſi*, hujus loci non eſt, *Bufonites* D. *Chriſtopheri Meret* (ſi locum memini) Lapides non erant, ſed ipſiſſimi *Lupi Piſcis Dentes*, *&c.* Quod quidem ſatis feliciter, ſive ab ipſo, ſive a quovis alio excogitatum: Quippe hi lapides aliud non ſunt, me Judice, quam *Luporum* aliorumque *Piſcium dentes*, habitu & veſtitu lapidum perſonati. In fodina *Garvordienſi* ſeptimo ab *Academia* milliari, (ob rariores quos habet lapides, diutius a me frequentata) tandem incidi in *Maxillæ piſcis* Fig. 122. ut videtur fragmentum, cui tres *Bufonites*, Triangulato quodam ordine, arcte inhærebant: Bini ſcilicet Orbiculati minores, & minimus tertius. Sed de Bufonitibus hæc dicta ſufficiant; quos ſi id magis placeat, *Ichthyodontes Scutellatos* in poſterum jure merito appellare poteris.

15. *Plectronites levis Mucrone paulo acutiore*. *Plectronites* non aliud eſt quam *Ichthyodos* quidam teretiformis, Plectrum Gallinaceum referens radice *Bufonitis* inſtar, excavata. Colore, Superficie & Magnitudine, ut reliqui, *Ichthyodontes* variant. Paſſim in Lapicidinis *Bercherianis*, cum *Bufonitibus* & *Gloſſopetris* inveniuntur. Striato Perioſteo denudatos ſuſpicor quotquot Marmoris ad inſtar Politos cernimus. Fig. 123.

16. *Plectronites major altiuſcule Striatus*, *Mucrone magis obtuſo*. Hujus Lapidis non niſi duo Exemplaria hactenus videre contigit. E Fodina *Stunsfeldienſi*. Fig. 124.

17. *Rhombus minor* ſive *medius*, quem *Rhombum* appellare placuit; compreſſior eſt quidam lapis; præter propter Cucumerini Seminis magnitudine, Fig 125.

forma ad Rhomboidem accedenti. Ab uno latere convexior eſt, & Colore ut plurimum nigro; ex altero planior & Teſtacea quadam lamella obductus: quæ mire ſplendet, Colore Anthracino vel ex Atro rubenti, hæc teſtula, ſive teſtacea Lamella, Figuram Rhomboidalem conſtituit, Margine quandoque leviter inclinato; & quod materiæ Elegantiam, climatum Teſtudinis Exuvium quam proxime ſimilat. Invenimus in Lapicidinis Marchamenſibus & Charletoniæ. Dantur etiam & Majores & Minimi & quidam Figura a Rhomboidali multum diſcrepantes, Rhombum quoad Materiæ & Coloris elegantiam excipit.

Fig. 126 18. *Scalpellus.* Eſt autem *Scalpellus*, Lapis Figura ab omnibus hucuſque notis prorſus aliena. Quod ad magnitudindm ſpectat & Colorem, cum Rhombo aliquatenus convenit. At Figura eſt omnino ſibi propria. *Scalpellum* nominare volui, quoniam *Cultelli* Mucronem quodammodo mentitur. Nam Lamellatus eſt Lapillus, Figura tamen Trigonali, cum alio quodam Angulo minus eminenti. Facies altera omnino plana eſt & ſeſſilis; ſed altera ob demiſſum Marginem, ſeu mavis tranſverſas quaſdam Lineas eminentes, undiquaque leviter acclivis. *Charletoniæ* habui cum priore.

Fig. 127 19. *Bufoniti Congener Gibbus Lapis:* ſeu *Bufonites Gibbus* cognominatus. *Gibbus* autem lapis ex Re nomen habet: nam Bufonites eſt non ut reliqui plane ſeſſilis, ſed omnino arcuatus: adeo ut ſi in plano poſueris, lucem ſubtus recipiat. Atque hinc a Dorſo elatiori, apud nos Gibbi nomen ſortitus eſt. In parte *Gibboſa*, foramen obtinet at Baſin latiorem; ei prorſus ſimile quo cæteri donantur Bufonites minores. In arenoſis Marchamiæ Lapicidinis invenit optimæ ſpei Juvenis D. *Joannes Archer* e Collegio Reginenſi: qui inter alios Lapides aliquam multos, ejuſdem duo vel tria habet ſpecimina. Nos poſtea in Sabuleto *Faringdonenſi* obſervavimus.

Hactenus dictos *Lapides* ut et alios aliquam multos, quos in *Anglia Mediterranea* inveni, pro Piſcium Dentibus aliiſque Capitum Oſſiculis aut habeo, aut vehementer ſuſpicor. Cæterum & eorundem Vertebras non paucas undiquaque in Agris Gloceſtriæ, Bercheriæ et Oxonii ſparſas, obſervare licuit; quos omnes generali nomine.

Fig. 128 20. *Ichthyoſpondylos* appellare conſuevimus. Sunt autem ii vario pro conditione loci, Tincti; alii nigri, fuſci alii, quidam ſubluteì aut cinerei. Magnitudine etiam et Forma non minus varia ſunt quam *Ichthyoſtea*, ſuperius dicta. Invenimus qui Latrunculos Luſorios Magnitudine exſuperent; atque etiam Viciæ Semine minores. In arenoſis Fodinis Marchamenſibus, ſine ulla fere (ut mihi viſum eſt) Materiæ Oſſeæ jactura conſervatos vidimus. Porro *Ichthoſpondyli* aut raro aut nunquam inveniuntur pluribus ſimul junctis, ut Piſcium Vertebræ; Magno quidem Indicio, Me Judice, has non eſſe Lapides ſpontaneos, ad Imaginem (cognatæ quantumvis Materiæ) Oſſium formatos. Nam ſi Natura ſubterranea, quod Marina perficit, præſtare conatur quidni eodem Opere ac Labore, quo Singularem Piſcis Vertebrarum, integrum ſaltem Sceleton, ut cætera nequeat, conficeret;

Fig. 129 21. *Maxillæ Piſcis* Fragmentum Lapideum, cum adnatis Bufonitibus, Garvordiæ inventum.

2. *Gloſſopetra*

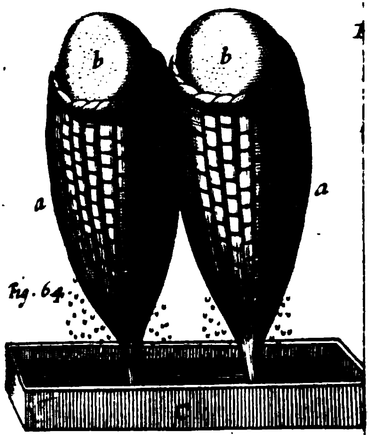


Fig. 64.

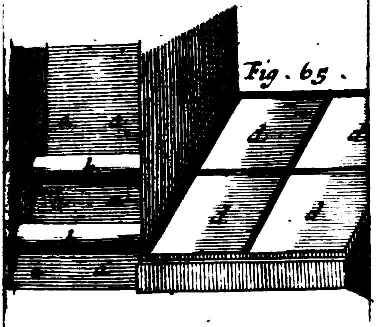


Fig. 65.

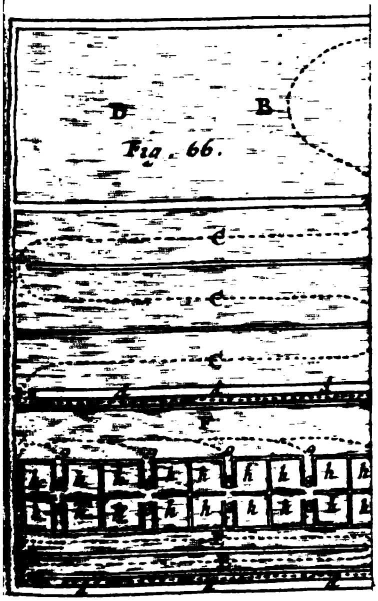
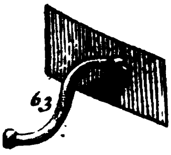


Fig. 66.



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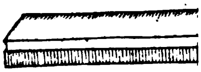

Fig. 129

n. 243. p. 279
Fig. 130, 131, 132, Fig 133, 134, 135, 136, Fig 137. Fig. 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148.

n. 252. p. 187
Fig. 149, 150.

By Dr. Sloan, ib. p. 188.

The Giants Causway in Ireland, By Sir R. Bulkley, n. 199. p. 708.

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Fig. 129 G

22. *Gloſſopetra* exigua cum *Mandibulæ* fragmento Lapideo adnato. *Faringdon*, Fig. 129

23, 24, 25, We found near *Lhan Deilo* in *Caermardhinſhire*, 26, 27, 28, 29, on the *Severn* Shore in *Gloceſterſhire*; 30, at *Gold Cliff* in *Monmouthſhire*, and all the reſt in the Iſle of *Caldey* in *Pembrokeſhire*. The 25th *Fig.* 132. whereof we found great Plenty, muſt doubtleſs be referred to the Sceleton of ſome flat Fiſh; the 23*d*, and 24*th*, I know not at all what to make of; The reſt are *Modioli*, or *Vertebræ* of Sea-ſtars, for I have been long ſince fully ſatisfied, that all ſorts of *Entrochi* and *Aſteriæ* muſt be referred thither; not that I conclude that either theſe, or any other Marine Terreſtrial Bodies were ever really, either Parts or *Exuviæ* of Animals; but that they bear the ſame Relation to the Sea-ſtars, that *Gloſſopetræ* do to the Teeth of *Sharks*; the Foſſil-ſhells to the Marine ones, &c.

n. 243. p. 279 Fig. 130, 131, 132, Fig. 133, 134, 135, 136. Fig. 137. Fig. 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148.

Fig. 149, 150. Repreſent a *Limeſtone Marble*, we have lately diſcover'd in *Wales* when poliſh'd. We have Plenty of it, but few pieces exceed 6, 9, or 12 Inches Diameter, for 'tis only a ſort of *Alcyonium*, incorporated in ſeveral ſmall Blocks of the *Limeſtone*, whereof *Fig.* 149. Repreſents a piece poliſhed perpendicularly, and *Fig.* 150, Horizontally. 'Tis to me more Beautiful than the *Florentine Marble*, but much more hard and ſubſtantial.

n. 252. p. 187 Fig. 149, 150.

N. B. This Stone is a ſort of *Coral*, and the *Lapidis Aſtroitidis* ſive *Stellaris primum Genus. Boet. de Bodt*; or *Aſtroites, Worm. Muſ.* It grows in the Seas adjoyning to *Jamaica*. It is frequently found foſſile in *England*. I have ſome of it that will poliſh as well as *Agat*, which was many Years ſince found out by Mr. *Beaumont*.

By Dr. Sloan, ib. p. 188.

LXXVI. 1. This Deſcription of the *Giant's Cauſway*, I received from a Scholar and a Traveller, who went on purpoſe the laſt Summer 1692, with the Biſhop of *Derry* to ſee it. It is in the County of *Antrim*, about 7 Miles Eaſt of *Colrain*, and 31 Miles to the Eaſt of the Mouth of the River *Derry*. The Coaſt there is a very great Height from the Sea: And from the Foot of the Precipice, there runs out Northward into the main Ocean, a raiſed *Cauſway* of about 80 Foot broad, and about 20 Foot high about the reſt of the Strand; its ſides are perpendicular, it was about 200 Foot in View to to the Sea-water.

The Giants Cauſway *in* Ireland, *By* Sir R. Bulkley, n. 199. p. 708.

This whole *Cauſway* conſiſts all of Pillars of *Perpendicular Cylinders, Hexagones* and *Pentagones*, of about 18 and 20 Inches Diameter, but ſo juſtly ſhot one by another, that not any thing thicker than a Knife will enter between the ſides of the *Pillars*. When one walks upon the Sand below it, the ſide of this *Cauſway* has its Face all in *Angles*, the ſeveral Cylinders (pardon the Impropriety of the Word) having ſome two, ſome three of their ſides open to View. The very vaſt high Precipice does alſo conſiſt of Cylinders; tho' ſome ſhorter and ſome longer: And all the Stones that one ſees on that Coaſt, whether ſingle or in Cluſters, or that riſe up any where out of the Sand, are all *Cylinders*, tho' of never ſo different Angles; for there are alſo Four-ſquared upon the ſame Shore.

2. The

By Dr. Sam. Foley, n. 212. p. 170. The *Giants Cauſway* is ſomewhat more than 8 *Engliſh Miles* North-Eaſt from the Town of *Colerain*, and about 3 from the *Buſh Mills*, almoſt directly North. It runs from the bottom of an high Hill into the Sea, no Man can tell how far, but at *Low-water* the Length of it is about 600 *Foot*, and the Breadth of it, in the broadeſt Place 240 *Foot*, in the narroweſt 120 *Foot*. It is very unequal likewiſe in the Height, in ſome Places it is about 36 Foot high from the Level of the Strand, and in other Places about 15 *Foot*.

It conſiſts of many thouſand Pillars, which ſtand moſt of them perpendicular to the Plain of the Horizon cloſe to one another, but we could not diſcern whether they do run down under ground like a *Quarry* or no. Some of them are very long and higher than the reſt, others ſhort and broke; ſome for a pretty large ſpace of an equal Height, ſo that their Tops make an even plain ſurface, many of them imperfect, crack'd and irregular, others entire, uniform and handſome, and theſe of different ſhapes and ſizes. We found them almoſt all *Pentagonal* or *Hexagonal*, only we obſerved that a few had 7 ſides and many more *Pentagons* than *Hexagons*, but they were all irregular: For none that we could obſerve had their ſides of equal Breadth; the Pillars are ſome of them 15, ſome 18 Inches, ſome 2 Foot in Diameter, none of them are one entire Stone, but every Pillar conſiſts of ſeveral Joints or Pieces, as we may call them, of which ſome are 6, ſome 12, ſome 18 Inches, ſome 2 Foot deep.

Theſe pieces lie as cloſe upon one another as 'tis poſſible for one ſtone to lie upon another; not jointing with flat ſurfaces, for when you force one off the other, one of them is always concave in the middle, the other convex. There are many of theſe kind of Joints, which lie looſe upon ſome part of the *Cauſway*, and on the Strand which were blown or waſhed off the Pillars. Theſe Joints are not always placed alike, for in ſome Pillars the *Convexity* is always upwards, and in others it ſtands always downwards. When you force them aſunder, both the *Concave* and *Convex* Superficies are very ſmooth, as are alſo the Sides of the Pillars which touch one another, being of a *whitiſh Free Stone* Colour, but a finer cloſer Grit, whereas when we broke ſome pieces off them, the inſide appear'd like dark *Marble*.

The Pillars ſtand very cloſe to one another, and tho' ſome have 5 Sides and others of them 6, yet the Contextures of them are ſo adapted, that there is no Vacuity between them; the Inequality of the Numbers of the ſides of the Pillars, being often in a very ſurprizing and a wonderful Manner, throughout the whole *Cauſway*, compenſated by the Inequality of the Breadths and Angles of thoſe ſides; ſo that the whole at a little Diſtance looks very regular: And every ſingle Pillar does retain its own Thickneſs, and Angles and Sides, from Top to Bottom.

Thoſe Pillars which ſeem to be entire as they were originally, are at the Top flat and rough, without any Graving or *ſtriate* Lines; thoſe which lie low to the Sea are waſhed ſmooth, and others that ſeem to have their natural Tops blown or waſhed off, are ſome concave, and others convex.

The high Bank hanging over the *Cauſway* on that ſide which lies next it, and towards the Sea, ſeems to be for the moſt part compoſed of the common

ſort

Plate 6. Vol. 2. Pag. 512.

Fig. 145.

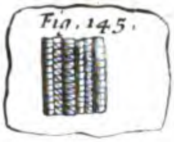


Fig. 136.

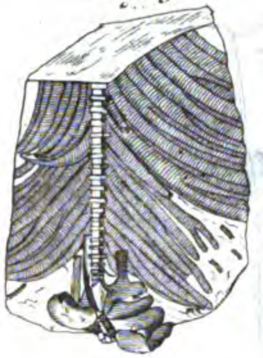
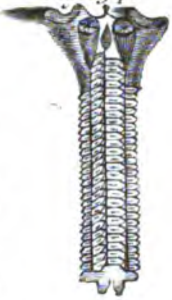


Fig. 134.



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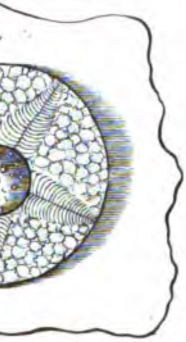
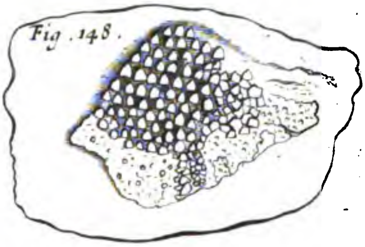


Fig. 148.



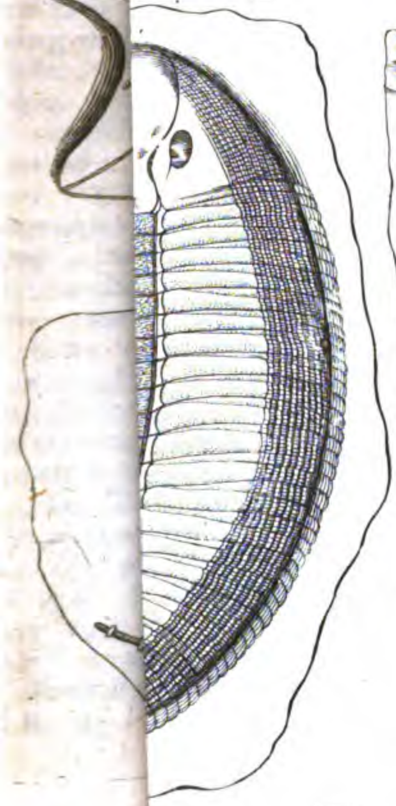
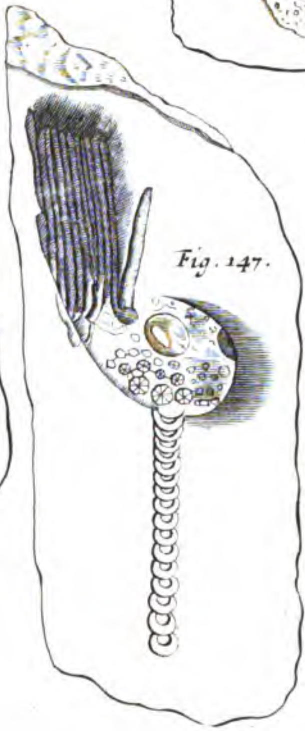


Fig. 147.



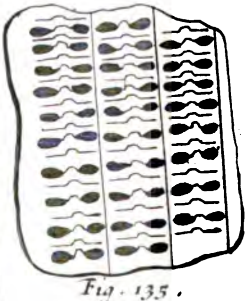


Fig. 135.

By *Dr.* Sam.
Foley, n.
212, p. 170.

ſort of Craggy Rock; only we ſaw a few Irregular Pillars on the Eaſt-ſide, and ſome farther on the North, which they call the *Looms*, or *Organs* ſtanding in the ſide of a Hill; the Pillars in the middle being the longeſt, and thoſe on each ſide of them ſtill ſhorter and ſhorter: But juſt over the *Cauſway*, we ſaw as it were the Tops of ſome Pillars appearing out of the ſides of the Hill, not ſtanding, nor lying flat, but ſloping.

We ſuppoſe each Pillar, throughout the *Cauſway*, to continue the ſame to the very bottom, becauſe all that we ſaw on the ſides were ſo.

2. The ſeveral ſides of one and the ſame Pillar are as in the Planes of *Cryſtals*, of very unequal breadths or lengths, call it either, when you Meaſure them Horizontally, and that in ſuch as are *Hexagonal* a broader ſide always ſubtends, or is oppoſite to, a narrower, which ſort of *Geometry* Nature likewiſe obſerves in the Formation of *Cryſtals*. ib. p. 174

3. Among the ſeveral *Figur'd Stones* already deſcribed by Authors, I find none that has more Agreement with thoſe which compoſe our *Giants Cauſway* than the *Entrochos*, the *Aſtroites*, or *Lapis Stellaris*, and the *Lapis Baſanus* or *Baſaltes*: And yet for all the great Reſemblance they have in ſome particulars, they differ very much in others. *By Dr.* Tho. Molyneux. ib. p 175.

The *Entrochos* agrees with the *Pillars* of our *Cauſway* in that it is a ſtony ſubſtance, formed by Nature *Column-wiſe*, and conſiſting of 20 or 30 ſeveral *Internodia*, or *Joynts*, ſet one a top of another; but then it differs in that its outward ſhape is round and *Cylindrical*; in its having a *Hole*, or *Pith*, run from top to bottom through all the Joints; in the ſetting on, or way of fitting one Joint to another; and in its ſize and Magnitude.

The *Aſtroites* or *Lapis Stellaris* is not only ſhap'd *Column-wiſe*, as the *Entrochos*, and jointed with ſeveral *Internodia* cloſely adjuſted to one another, but its ſides are *Angular*. But then it muſt be obſerv'd that the ſides of the *Aſtroites* are always *Sulcated*, or a little furrowed, and are conſtantly *Pentagons*; whereas the *Iriſh-ſtone* has its ſides perfectly ſmooth, and *Plane*, and ſometimes in *Hexagons* and *Heptagons* as well as *Pentagons*. Moreover the *Aſtroites* has Furrow'd and Protuberant *Rays* ſtriking from its Center, ſomewhat as they draw a Star. Whence it has its Name, that adaping the *Concavities* and *Convexities* together, cauſe the Cohæſion of the Joints to one another; whereas the Internal Superficies of the *Internodia* in our *Iriſh-ſtone* ſends forth no ſort of *Rays* from its Center, and unite to one another by a quite different *Articulation*. For beſides what Dr. *Foley* remarks of the bottom or top of each Joynt, having a large round *Concavity* or *Convexity* that extends it ſelf from the Center of the Stone within an Inch or two of the Angular Circumference, examining two Joints that were ſent up from the place hither to *Dublin*, I obſerv'd likewiſe, that the bottom or top of each Joint round this *Concavity* or *Convexity* either Riſes with an eminent *Verge*, or *Ridge*, if it be *Concave* in the middle or if it be *Convex*, is hollowed with ſuch a ſort of Groove, as to receive cloſely into it all the Eminent Ridge of the next Joint either above or below it; ſo that each Superficies in the *Articulations* adapt themſelves on all ſides ſo exactly one to t'other, as 'tis poſſible for two Bodies, that are only Contiguous, and not Cohæring.

The *Aſtroites* alſo as well as the *Entrochos*, differs extremely from our Stone in its *Size*, or *Magnitude*, for the largeſt that is found of either of thoſe kinds, do not much exceed the thickneſs of a Man's Thumb, whereas our *Columns* are ſome of them two Foot in Diameter. Yet this Diſproportion of bulk is not ſo conſiderable a difference, ſince we obſerve that Nature Affects the like Diſparity in other of her Works, and thoſe too nearly allied, and evidently of the ſame Tribe, or Family. Our ſmall *Jointed Ruſhes* or *Reeds*, and the largeſt *Eaſt Indian Bambou*, one of which I remember to have ſeen in *Holland* above 26 Foot high and as thick as a Man's middle, are yet *Plants* of the ſame Species and Claſs.

But nothing among all the *Foſſil* Tribe that I have ſeen or read of, comes ſo nigh in all reſpects in its formation, ſubſtance, ſize, way of growth or manner of ſtanding, *&c.* to the *Columns* whereof this *Cauſway* is compoſed, as the *Lapis Baſaltes Miſenus*, deſcribed by *Kentmannus* in *Geſner de Figuris Lapidum*, whereof he ſays there is a great large Bed within three Miles of *Dreſden* in *Saxony*. He gives the following Account of it thus in his own Words.—— *Lapides Anguloſi plures coagmentati* Baſalton *repræſentat, qui creſcit forma & magnitudine Figni mediocris, Singularis quidem ſed Copioſus atque ita Junctus Coaptatuſque, veluti ab* Arculario *arte commiſſus eſſet*; ſeptem, ſex, quinque, *nonnunquam ſed rarius* quatuor Angulorum: *Omnino Figura Trabis erectæ, foris Lævis, & Tactu minime Aſper, Ferrugineus Ponderoſus, Duritie velut Adamantis*; *H. Lapides ſic Coagmentati e terra Ulnas decem & ſeptem extant*; *Quanto ſpatio intra Terram condantur, nemini adhuc exploratum eſt.* But, I find this difference between theſe and the *Miſnean Baſaltes*, that its *Columns* were one entire piece from top to bottom, whereas our *Iriſh Baſaltes*, is compoſed of *Columns* divided into many Joints. So that I think it may not improperly be called, to diſtinguiſh it from this and all other *Foſſils*,

Lapis Baſaltes *vel* Baſanos Maximus Hibernicus *Angulis minimum Tribus, plurimum Octo conſtans; crebris Articulis ſibi invicem affabre conjunctis, ſed facile ſeparabilibus, Geniculatus.*

Whether our *Iriſh Baſaltes* can pretend to the Name *Baſanos*, on the ſame account the *Miſnean* does, from the *Greek* word *βασανιζω Exploro*, becauſe it has the property of the *Touch Stone*, that ſhews by Lines drawn with Metals on its ſmooth Surface, which are Genuine, and which Adulterate, I cannot poſitively ſay; becauſe thoſe Pieces I have, are ſo rough, that unleſs ſome part of the Superficies were Artificially Poliſhed, the Experiment cannot be made: Yet I have reaſon to believe it would ſucceed, were the Stone poliſhed; becauſe I fine *Black Marble* in general, ſo it be of a cloſe Texture and hard, as this is always partakes of that Property.

A further Account of the Giants Cauſway; *By Dr.* Tho. Molineux. n. 235. *and* n. 241. p. 209.

4. To have a juſt Idea of this Wonderful Production, I propoſed the laſt Summer 1697. to ſome Philoſophical Gentlemen here in *Dublin*, that we ſhould imploy, at our common Charge, one Mr. *Sandys*, a good Maſter in Deſigning and Drawing of Proſpects, to go into the North of *Ireland*, and upon the Place take the Genuine and Accurate Figure of the whole Rock, with the Natural Poſture of the Hills and Country about it for

ſome diſtance; accordingly we ſent him away with ſuch Inſtructions as I drew up for him, and he returned ſoon after with a fair and beautiful Draught, very expreſſive of each Particular we deſired.

A. The *Great Cauſway*, which is from *B*. to *C*. 135. Yards, from *D*. to *E*. 120 Yards, and from *F*. to *G*. 64 Yards.

H. The *Imperfect Cauſway*, which is 120 Yards long. *Fig*. 151.

I. Stones, the ſame as thoſe of the *Cauſway*, which lie on their ſides in the Hill.

K. Rocks in the Sea, which appear to be the ſame ſort of Stone.

L. The *Organs*, which are *Pillars*, the ſame with the *Cauſway*.

M. The *Chimneys*, which are Stone and make that Figure.

The *Prick'd Line* in the *Cauſway*, ſhews how far the Sea Flows at High-Water.

Fig. 152. The Proſpect of the Eaſt ſide of the *Cauſway*.

There are alſo ſeveral of theſe kind of Stones ſeen in the ſides of the Rocks. *Fig*. 152.

But the moſt inſtructive part of the Scheme is that which expreſſes all the *Various Figures* of the ſeveral *Joynts* and *Columns* that have been found by careful Obſervation to make up the *Cauſway*.

N. A Joynt but of 3 ſides.
O. A Joynt of 4 ſides. *Fig*. 153.
P. A Joynt of 5 ſides.
Q. A Joynt of 6 ſides.
R. A Joynt of 7 ſides.
S. A Joynt of 8 ſides.

Fig. 154. A Piece of a *Column* of 6 Sides, Tranſverſly divided in the middle, the uppermoſt part *a*. laid cloſe by the lower part *b*. that the Manner may the better and more plainly appear, how the *Convexity* or *Riſing* of the Joynt below, mark'd *c*. was let into the hollow of the Joynt above, mark'd *d*. when that was in it's Native Poſture, ſtanding a top and covering it. By this ſort of *Articulation* the ſeveral Joynts of the *Columns*, whether they conſiſt of 3, 4, 5, 6, 7, or 8, ſides, Adapt and Unite themſelves to one another; and obſerve, in all the reſt of the Figures, *c*. denotes a *Convexity* or *Riſing*; *d*. a *Cavity* or *Hollowneſs*, in the Stone. *Fig*. 154.

Fig. 155. Is a Collection of 7. *Columns* as they ſtand together in the *Cauſway*; and ſhew that though the *Pillars* differ from one another in their *Shape* and *Angles*, yet they adjuſt their ſides in ſuch a manner to the next immediate adjoyning *Columns*, that their remains no *Vacuity* between them: For the *Pillars* are of ſuch various Figures, that all ſort of Interſtices, of what ſhape ſoever, are entirely fill'd up by one or other of them. *e e e e* the ſides of the Pillars which ſhew by their outward Surface, that each *Column* conſiſts of many Joynts placed one above another, from top to bottom; and theſe Joynts ſo cloſely Contiguous, that only a ſmall Creviſe or Line ſeems to ſever them; ſome with their *Convexities* uppermoſt, as thoſe mark'd *c*. others with their *Concavities*, as thoſe mark'd *d*. *Fig*. 155.

The *Triangular*, *Quadrangular*, and *Octangular Pillars* are much fewer in Number than thoſe other *Figur'd Columns*: So that they do not come readily in ſight, except they be carefully ſearched after.

But this ſort of Stone is not more remarkable for being Cut thus naturally into *Regular Geometrical Figures*, than for being found in ſuch Plenty and vaſt Abundance in many parts of this Country, for 4 or 5 Miles about. For beſides what goes under the vulgar Name of the *Giant's Cauſway*, which it ſelf alone is of a great Extent, and how far it may run into the Sea none can tell, there are many other Collections of the ſame kind of *Pillars*, ſituated in and about this Place; as two leſſer but more imperfect and broken *Cauſways* as we may call them that both lie at ſome diſtance o'the Lift Hand of the great one, as you face the North; and a little farther into the Sea, ſome Rocks ſhew themſelves above Water, when the Tide is low, that ſeem all made ſtill of the ſame Stone. And if you Aſcend towards the Land in the Hill above the *Cauſway* next and immediately adjoyning to it, you meet with more of the ſame ſort of *Pillars*, but in a different Situation, not Perpendicular and Erect, but lying as 'twere on their ſides, in a ſlanting Poſture.

Beyond this Hill Eaſtward, at ſeveral diſtances, ſtand many ſets of ſtraight and upright Columns ranged in Curious Order along the ſides of the Hills: That Parcel of them which is moſt Conſpicuous and neareſt the *Cauſway*, the Country People call the *Looms* or *Organs*, from its formal Shape; which is ſo very Regular, that all its ſeveral *Pillars* may be diſtinctly counted, and they are juſt 50 in Number; the largeſt and talleſt, at leaſt 40 Foot high, conſiſts of 44 diſtinct Joynts, and ſtands directly in the middle of all the reſt, they gradually Decreaſing in length on both ſides of it, like *Organ Pipes*.

Four Miles Weſtward of the *Giant's Cauſway*, a Mile and a half diſtant from the Sea, three Miles from the Town of *Coleraine*, and about two from *Dunluce*, an old Seat of the Marquis of *Antrim*, ſeveral Ranges of tall Pillars ſhew themſelves, along the ſide of a Rock, for about 300 Paces together; a Church within a Quarter of a Mile of them, called *Ballywillan* Church, I am told, was Built for the moſt part with Stone taken from thoſe Pillars, which are all of the ſame ſort of Stone with the Columns of the *Giant's Cauſway*, (as I find by carefully Examining and comparing together pieces of them both I have now by me) and like thoſe too, conſiſt of Regularly cut, looſe and diſtinct Joynts placed one upon the top of t'other; but in theſe Reſpects they differ.

1. That ſome of theſe Inland Pillars are of much larger ſize than any in the *Cauſway*, being two Foot and a half in Diameter.

2. That there are only found among theſe, ſuch as have 3, 4, 5, and 6 ſides, and none that have 7, and 8, like ſome of the *Giant's Cauſway*.

3. That the Joynts of theſe do not obſerve that kind of *Articulation*, by Cavities and Convexities, as thoſe of the *Cauſway* do; but their upper and lower Surfaces Touch only in Planes, and they ſtand united by means

of their Weight and Preſſure alone; ſo that a ſmall force will ſever them.

But I find by obſerving the manner of the Commiſſure, or way of *Articulation*, in Six Couple of the ſeveral ſorts of Joynts of 3, 4, 5, 6, 7, and 8, ſides, which I had raiſed on purpoſe, and taken out of the *Cauſway*, as they were naturally fellow'd in *Pairs*, that ſome of the Joynts actually want this Cavity and Riſing, as thoſe of 4 and 6 ſides I have now in my Houſe, and are only united to one another by Superficies touching cloſe in Plains that run a little ſlanting and not Parallel to the Horizon. Yet this may be only a Chance Formation, ſince the Univerſal Joynting of the whole *Cauſway*, is certainly otherwiſe. But I muſt take notice, that the Hollows and Convexities are not conſtantly form'd and moulded in the Stone with all that Accuracy and Circular Exactneſs, the Artiſt has pleaſed to expreſs them in the Figures.

Theſe Cavities in ſuch Joynts as are uppermoſt, and lie expoſed to the open Air on the Surface of the *Cauſway*, afford no ſmall uſe and advantage to the Poorer ſort of the People in the Neighbouring Country, with whom it is a common Practice in the Summer Time, when they want Salt, to fill theſe natural Baſons with *Sea-Water*, which by reaſon of their Shallowneſs are of ſo Commodious a ſhape, that in the ſpace of four Tides they find all the Water that was left in them exhaled, and the Salt remaining dry in the bottom of the Hollows.

But there is another Irregularity I muſt take Notice of, which is, that one of the Joynts of the *Cauſway*, a *Pentagon*, ſent me hither to Town is *Cavous* both at top and bottom: But the general Formation is this, that if a Joynt be *Concave* at one end, the other end is *Convex*.

The vaſt Towering height of thoſe Strait Joynted Pillars, eſpecially of thoſe that are moſt ſlender and the perfecteſt among them, is truly very ſurpriſing. There are in the *Cauſway*, ſome of 32 others of 36 Foot high above the Strand, and as I ſaid before, ſome among the *Organs* equal 40 Foot in height. How far theſe may be continued under Ground is not yet diſcovered: But a Gentleman of my Acquaintance trac'd one of the Talleſt *Pillars* of the *Cauſway* by digging into the Strand, and it continued ſtill of the ſame make and Figure, Joynted as it was above, for the depth of 8 Foot together, and he found no Reaſon to doubt but he might have trac'd it much farther.

This is obſervable, that commonly the Joynts, as well of the Inland Pillars, as thoſe of the *Cauſway*, as they have their Situation nigher the Earth, are longer and taller than thoſe towards the top of the Column; but no difference is obſerved in the Cavities or Riſings of the Joynts, as they are placed higher or lower in the ſame Pillar, they continue much the ſame as to their depth or Protuberance from top to bottom: Yet the utmoſt top of ſuch of the Pillars that ſeem Compleat and Entire, always Terminates with a Joynt that's flat on the upper ſide, and no way either Concave or Convex like all the reſt below it.

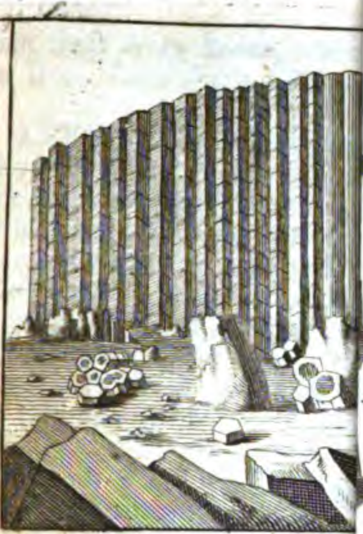
As to the Internal Subſtance of this Stone, 'tis of an Extraordinary hard, cloſe, and compact Texture: Its Greet, or Grain; ſo very even and fine that it hardly appears, unleſs viewed near the Eye, and when the Stone is newly broke: Then it ſhews it ſelf on its Surface like a very Minute ſmall Gliſtning Sand thickly interſperſed with the reſt of the Solid; which by Reaſon its parts are ſo firmly combin'd together, has ſomething more of Gravity, in Proportion to its Bulk, than moſt other ſorts of Stone, unleſs ſuch as partake of the *Marchaſite* or *Pyrites*, and are more Ponderous than uſual from a *Metalline* Principle, being an Ingredient in their Compoſition; of which this does not at all Participate, or at leaſt not in any conſiderable Quantity that I can diſcover.

It ſeems as if it were one Plain Homogeneous Body, without any Mixture of *Cochlite*, *Belemnite*, *Veins* of *Spar*, or ſuch like Extraneous Matter, ſo commonly met with in moſt other ſtony Concretes: Nor can there be obſerved *Rays*, *Furrows*, *Striæ*, or any manner of Lines running along its Superficies; ſo that it is capable of a good Poliſh, and I find has in Perfection that quality of the *Lapis Lydius*, *Baſanus* or *Touchſtone*, ſo much Celebrated of Old, for ſhewing the various Impreſſions different Metals make upon it when rub'd or drawn along its Surface; but being a Stone naturally divided into ſmall Pieces or Joynts, and of ſo hard a Body, that it turns or breaks the Edges of the beſt Tools, when they offer to cut it, it ſeems unfit for the imbelliſhing of Houſes, and all the other greater uſes of *Architecture* and *Statuary*.

Its rough and natural outſide that's expoſed to the open Air, and beating of the Weather, is of a Whitiſh-Colour, much the ſame with that we ſee on common Rocks, and Lime-ſtone; but the inſide, when you ſever one piece from another, is of a Blackiſh Iron Gray, like that of the beſt Black Marble before 'tis poliſh'd, but ſomewhat of a darker Shade. And indeed I can diſcover but little, if any, difference between the Subſtance of this Stone and that of Marble. 'Tis true, the moſt common ſort of Marble is not near ſo hard and cloſe a Body; yet that does not import much, ſince 'tis known that ſeveral kinds of Marble vary extreamly from one another in hardneſs.

Georgius Agricola, in his Book *de Natura Foſſilium*, has a Paſſage (and which I find confirmed too, by a later Author living in that Country, *Lachmand de Foſſilibus*, *&c.*) wherein he mentions a ſort of Marble found in the Diſtrict of *Hildeſheim* in *Germany*, that ſeems to bear in ſeveral Reſpects, a great Analogy or Agreement with this Stone of the *Giants Cauſway*. *In* Hildeſheimo *quoque e regione* Arcis Marieburgi *Collis eſt plenus* Lapideis Trabibus *quarum Capita interdum eminent*, *ſunt vero Perlonge acervatim poſita*, *inque medio earum Terra eſt Colore Nigro*, *Ferro aut altero Lapide percuſſa non aliter ac* Marmor Hildeſheimum *Cornu Uſti virus olent*, *omninoque ex eadem Materia ſunt*. He does not indeed tell us the preciſe Figure of theſe Marble Beams, yet it ſeems probable at leaſt that ſome were Square, which makes him call them, *Trabes Lapidea*. But however that might be, this I'm aſſur'd of from frequent Experiments, that the Marble of the *Giant*'s *Cauſway*

like



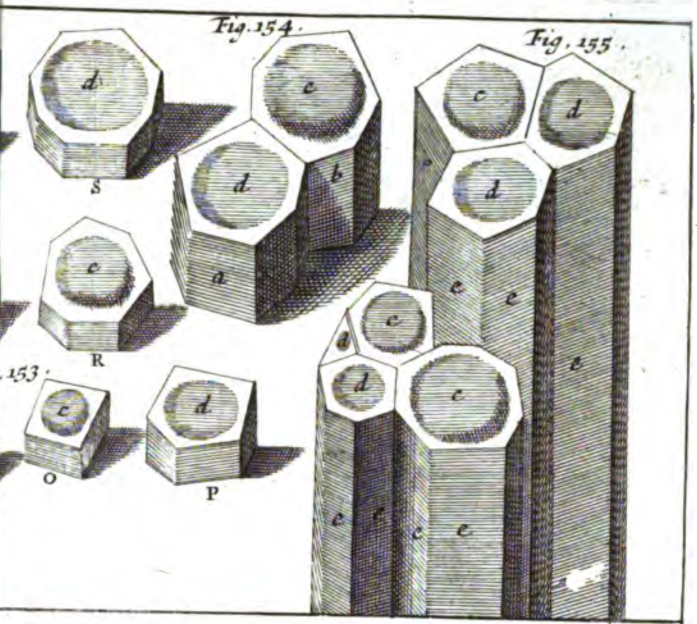
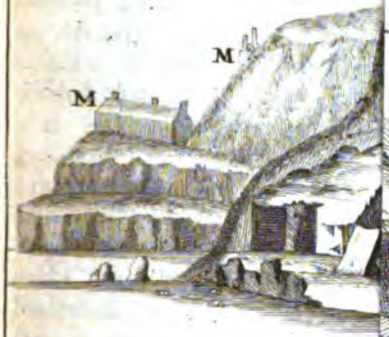
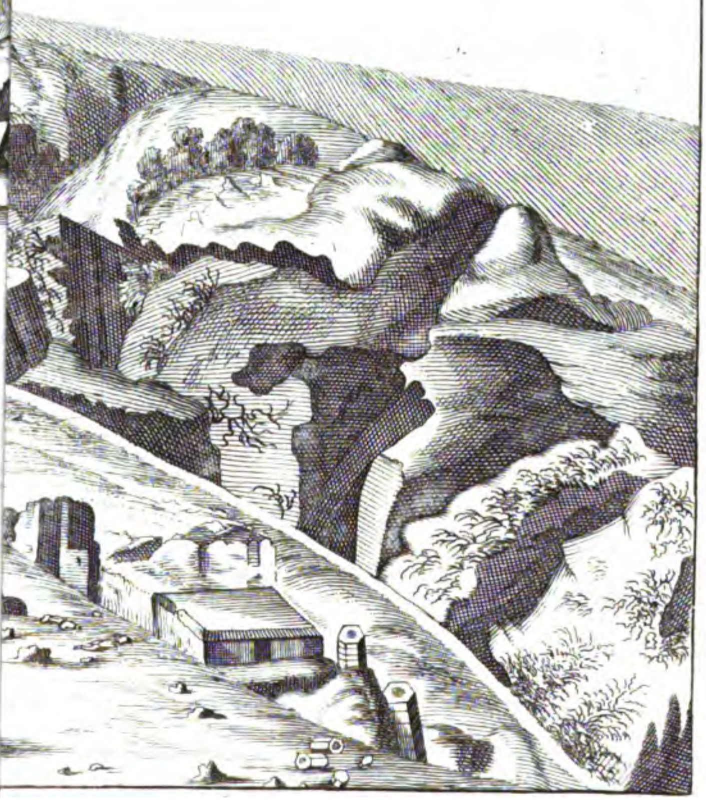


Fig. 154.

Fig. 155.

153.





like theſe *Stony Beams*, when forcibly ſtruck with another Stone or a Bar of Iron, ſends forth a ſtrong offenſive Scent like Burnt Horn.

LXXVII. The beſt way to explicate the *Vegetation* of *Rock-Plants*, is, firſt, To Repreſent the ſeveral ways of the Growth of *Spar*, which (to paſs by the Account from *Helvetia*, that Snow by long lying and continual Froſts is hardened into *Spar*) I obſerve to be three; Either 1 it takes a Being from Steams alone; or 2 from Steams Coagulating, either Dew as it falls on the Ground, or Waters iſſuing from the joints of Rocks under Ground; or 3 it Grows from Earths and Clays. We have an Inſtance of the firſt in many *Grotto's*, where ſome *Spars*, produced from Steams alone, hang from the Roofs like *Icicles*; *Lead-Ore* often growing in the ſame manner: And as this *Spar* grows downwards, ſo in many Places from the ſides of it there iſſue little Plants of *Spar*, which ſhoot upwards contrary to the Growth of the other. Thus *Spars* grow from Steams about the *Baths* at *Buda* in *Hungary*, according to the Relation of Dr. *Brown*. An Example of the 2*d* is given above; where 'tis ſaid, that at a certain Place in *Italy*, Cryſtals (which are a ſort of *Spars*) are produced in clear Evenings by a Congulation of Dew falling on *Nitrous Steams*. We have ſome, of the like Riſe, on *Mendip-Hills*, our Miners finding ſometimes in Roads, where the Earth is bare, *Triangular* Cryſtals about 2 Inches in length and an Inch over, not with Sharp Angles, like the *Triangular* Glaſs, but with round and blunt Angles and carried up round at the Ends like a *Coco-Nut*; none of theſe being ever found in digging. I have alſo ſeen of the ſame ſort which were taken up in *Glouceſterſhire*. So again its commonly ſeen in *Grotto*'s, that *Steams Coagulating Waters* iſſuing from the Joynts of the Clefts, Produce *Spars* of all Colours. As to the 3d way of Generation, to wit, from Earths and Clays, becauſe I do not remember to have met, in any Author, with a Satisfactory Account thereof, I ſhall briefly relate to you what I have obſerved herein.

The Growth of Spar, and Formation of Rock-Plants, &c. By Mr. J. Beaumont n. 129. p. 734.

Vid. Sup. § LIX

Vid. Sup. Cap. II. § XXXIX

Vid. Sup. § LX.

There are in *Mendip-Hills*, and generally where Mines are, *Subterraneous Vaults* or *Grotto*'s, whereof ſome, which are pretty deep, and admit not Air too freely, and have other Conditions required, are ſaid by our Miners to be Quick, having often *Ore* in them, and ſtill lively coloured Earths, with ſome Moiſture and Lively *Spars*: Others, admitting Air 2 or 3 ways and having in them black and moiſt Rocks, and dry and rotten Shelly Stones, dark Earths, barren Sands, and the like, being ſaid to be dead. I have often ſearched both, and in ſome of the former, particularly in one of them, which is 35 Fathom deep, by a perpendicular Line (though the oblique deſcent of it makes it above 50 *Fathoms* to thoſe that go into it,) I diſcovered this proceſs of Nature in the *Formation* of *Spar*. There are in the bottom of this *Grotto* ſome Beds of Clay, and others of a Liver Coloured Earth which I take to be as good a Bole as any now in uſe; it is inſipid to the Taſte, but Smells well, eſpecially when dried; for, as it lies, it is Moiſt and like Paſte, made ſo partly by the diſtilling Waters, and partly by a

Vid. Sup. § II

Steam Incumbent on the place raiſed from thoſe *Waters* by the *Mineral Ferments*. This Earth and Clay there ſhoots up every where in *Spires* in all proportions in height, from the firſt Buddings out of it, till it comes almoſt as high as a Man's Finger; the biggeſt of them being in thickneſs about an Inch Diameter. Theſe Spires are all ruled up with Irregular Ridges and Furrows, and ſome ſooner ſome later, begin on the top to be congealed into *Spar*, and ſo gathering a Cruſt downward by degrees, are all at laſt turned into an abſolute *White Spar*, with ſome *Diaphaneity*. I diſcovered the ſame Earth in ſome places there growing *Spherical*, which whilſt it is Earth it is ſtill ſticking to its Bed; but afterwards, as it comes to be cruſted over and at laſt to be turn'd into *Spar* like the other, it grows clear off from its Root, as Fruit falls from the Tree when Ripe. I have by me of theſe *Spherical Stones*, from the bigneſs of an ordinary Bullet, to that of a great Pins-head, ſome turning to *Spar* ſooner than others: I found ſome quite grown off, ſome half grown, ſome *White Spar* outwardly, and Raw Earth in the middle, ſo that the Proceſs was as Plain to me as I could wiſh. I ſaw the ſame Earth in ſome Places there growing in an exact *Oval* Form, and turning into *Spar* not *Oval*, but raiſed on both ſides with an Edge round it like *Apricock ſtones*: And as theſe *Spherical* and *Oval-ſtones* are moſt exact in their Figure; ſo, notwithſtanding the Rector fails in this Vault to give a true *Sexangular Figure* to thoſe which I ſaid ſhoot up *Pyramidally*; yet there is a certain place on theſe *Hills*, where the *Spars* grow all *ſexangular*, both Points of them terminating into a *Pyramidal* Figure, *ſexangular* likewiſe, as the Veins of Cryſtal found in *Italy*, produced by a Coagulation of Dew; theſe with us probably having the ſame Riſe, lying alſo on the Surface of the Earth. Here I many acquaint you, that I find Talc on theſe Hills growing *ſexangular*; the ruſt, which oftentimes lies over Veins of *Lead Ore*, in many places ſhoots up *Pyramidally*, and is bounded round with 6 *Angles*, and ſometimes with 5; *Lead-Ore* it ſelf often ſhoots up *Pyramidally* with rough Irregular Lines round it, and in ſome places I find it bounded round very regularly with 4 Angles; in other places it grows branched like a Plant, as I have ſeen in a Mine where the *Stone-Plants* grow.

As to that Opinion which generally ſolves thoſe various *Phænomena* of the ſeveral Figured Stones, which we find in Mines and elſewhere, by ſaying, That they are part of *Plants* and *Animals*, or whole ones, *Petrefied*; it ſeems not to be grounded on Practical Knowledge. Thus when we find ſeveral ſorts of *ſhell fiſh* in Mines, as there are ſome in the Clay where thoſe Stone Plants grow, we muſt not fly to Petrefaction as though they had been brought there by the Sea or otherwiſe, and ſo Petrefied; but we muſt take that to be (as it is truly) the Natural Place of their Birth; ſome of them being Raw Clay, others of the ſame Texture with the Rock where they grow, and others of as abſolute a ſhelly Subſtance as any in the Sea; theſe being only different gradations of Nature, which can as well produce *ſhells* in Mines as in the Sea, there being no want of Saline or Earthly

Particles. Nor is there any great difference betwixt ſome ſorts of *Spars*, and *Sea-ſhells*; neither do I know, why *ſhells* might not as well be produced in Mines, as any ſorts of *Spars* are in the Sea; for Inſtance, the *Fungi Marini*, which are of a *Sparry* ſubſtance, ſome of them having their Surface all wrought with Flowers, as it were, which are only the *Terminations* of *Sparry Cells*, as in *Coral*; and *Coral* it ſelf is a ſort of *Spar*, which ſo well reſembles our Stone-Plants in its growth, eſpecially if ſome of it be jointed, as Mr. *Ray* informs us, that I know not a more apt Name for theſe than to call them *Mineral Coral*; unleſs ſome haply will rather ſay, they are *Fluores Arboreſcentes internodiis diſtincti*; and as I find the Bodies and Branches of ſome *Coral* are all Ruled up with Lines, ſo are many of theſe in ſome Mines, and are terminated with Cells like it.

Mr. *Liſter* Judges that *ſhells* found in Stone-Quarries were never any Part of an Animal; and gives this probable Reaſon for it, becauſe Quarries of different Stone yield us quite different Species of *ſhells*, not only one from another, but from any thing in Nature beſides, which either the Land, Salt, or Freſh Water, does yield. I have obſerved the ſame thing ſome Years ſince, and have now by me ſeveral Species of Stone reſembling *ſhell-fiſh*, which I gathered from Plowed Fields and Quarries, that are ſcarce to be Parallell'd, as I judge by all the Collections of Sea-ſhells extant. *Vid. Sup.* S. a. xxx

To examine this Opinion of *Petrefication* further; I only find, that the Thing ſuppoſed to be *Petrefied* becomes firſt Cruſted over with a Stony Concretion, and afterwards, as it Rots away inwardly, the *Lapideſcent* Juyce inſinuates it ſelf by degrees into its room, and makes, at laſt a firm *Stone*; reſembling the thing in ſhape; which may lead ſome to believe it really *Petrefy'd*. But, though a real *Petrefaction* were allow'd in ſome Caſes, it would not be Rational to plead this in all the Figured *Stones* we ſee, in regard of thoſe many grounds we have for the contrary. But I take theſe to be the chief Reaſons which make ſome ſo ready to Embrace ſo generally this Conceit of *Petrefaction*, becauſe they are prepoſſeſt with an Opinion againſt the *Vegetation* of all *Stones*, and for that they think it impoſſible for Nature to expreſs the ſhapes of Plants and Animals where the *Vegetative Life* is wanting, this being a Faculty peculiarly belonging to the *Soul*; whereas they ſeem to Err in both; for, as what hath been ſaid concerning our *Stone Plants*, may ſuffice to prove their *Vegetation*, ſo it will be as eaſy to ſhew, that Nature can and does work the ſhapes of *Plants* and *Animals* without the help of a *Vegetative Soul*, at leaſt, as it is ſhut up in common *Seeds* and *Organs*. To be ſatisfied of this, let them view the *Figurations* in *Snow*; let them view thoſe delicate Landskips which are frequently (at leaſt in this Country) found depicted on Stones, carrying the reſemblance of whole Groves of Trees, Mountains, and Valleys, *&c.* let them deſcend into Coal-Mines, where generally with us the Clifts near the Coal are all wrought with Curious Repreſentations of ſeveral ſorts of Herbs, ſome exactly reſembling *Fern-Branches*, and therefore by our Miners call'd the *Fern-Branch Clift*; ſome reſembling the Leaves of *Sorrel*, and ſeveral ſtrange Herbs, which haply the known *Vegetable Kingdom* cannot Parallel; and though it could, here can be no Colour for a *Petrefaction*, it being only a *ſuperficial Delineation.* The like may be ſaid of *Animals*, which are often found *Depicted* on *Stones*; as all *Mineral* Hiſtories will ſufficiently inform them. Now ſince here is no Place for *Petrefaction*, or a *Vegetative Soul*, we can only ſay, That here is that *ſeminal Root* (though hindred by the unaptneſs of the Place to proceed to give theſe things a *Principle* of *Life* in themſelves) which in the firſt Generation of things made all Plants, and, I may ſay, *Animals* Riſe up in their Diſtinct Species; God commanding the Earth and Waters to produce both, as ſome Plants and Animals riſe up ſtill in certain places, without any common Seed.

It is a thing of very difficult Search, to find what this *Seminal Root* is, which is the Efficient cauſe of theſe Figures: But it ſeems to me not very unapt to Explicate it according to the ſaying of *Heraclitus*; *Lux Sicca, Anima Sapientiſſima*, that is, where there is a ſtrong Internal Light to expand the Ideas, and a Drought to Terminate them, the Vertue of a Soul is ſtill Preſent which Imprints them in the matter. Hence we find Nature is moſt Buſie in the kind where her Intentions are highly raiſed by the Preſence of her chief *Principles*, Salts, Sulphurs, and Mercuries, promoting her Ferments, which cauſe ſome Internal Light and Drought, the *Ignes Fatui* being only ſhadowy Reſults from them: Thus we ſee over and in Beds of Clays and Marles, which have ſtrong Ferments, being well impregnated with Salts, there often lie Beds of *Marchaſites* full of *Luminous* Particles, and there we frequently find great numbers of *Lapides*, *Serpentarii*, and *Marchaſites* reſembling Snakes; and ſo ſeveral other Figur'd Stones, as the *Belemnites*, &c. And in the Joints of the *Lias Stones*, growing over Beds of Clay, we often meet with a great plenty of Elegant Landskips. In Coal-Mines, where the Sulphurs are ſtrong, we find great Lumps of very bright *Marchaſites*, and great Varieties of Herbs Depicted as is ſaid before. In Mines of Metals, where the *Mercuries* are generally Predominant, there are Landskips and Repreſentations both of Land and Sea Animals, whereof ſome carry a Lib. de Nat. Puerl. bulk, others are only ſuperficially delineated. Thoſe who endeavour to Explicate thoſe Figurations Mechanically, ſeem to have a harder Task; for, if they ſay with *Hippocrates*, *Spiritu Diſtenta omnia pro Generis Affinitate diſtant*; as though, when the Mineral Spirits had extended the Matter, it fell into thoſe Figures upon a Spontaneous Receſs, according to its proper Weight, which gives Order and Meaſure to things; as he Mechanically ſhews by a Bladder, into which, if Earth, Sand, and Filings of Lead be put, and Water be added to them, and we give them Motion by blowing in the Bladder through a Reed, firſt they are mixt together with the Water, but in a while continuing in a gentle Motion they ſeparate themſelves and retire each to its like, the Lead to the Lead, &c. I ſay, if it be Explicated thus, it ſeems difficult to conceive, how the matter ſhould come to have ſuch a Determinate Weight to run into ſuch Figures, without a *Specifical Rector* to intend and diſpoſe it, unleſs a general one be admitted, in whoſe Vertue all Known and Poſſible ſpecies are, which, firſt introducing Diſpoſitions in the Matter, he intentionally Works; and, as ſometimes he gives that

Weight to the Matter, not endowing it with a *Principle* of *Life*, ſo he often diſpoſes it to receive Life and introduces it; which Poſition I conceive will hold good, notwithſtanding ſome late Induſtrious Eſſays to prove that there is no Equivocal Birth.

LXXVIII. Here is lately found in *Cheſhire*, a *Rock* of *Natural Salt*, from which iſſues a Vigorous ſharp Brine, beyond any of the Springs made uſe of in our *Salt-Works*. There runs near it (at leaſt in the Winter Seaſon) a ſmall Rindle (or Gutter rather ;) but it is wholly free from all Danger of Overflowing, which threatens all other *Salt-Pits* in this Country every great Shower, through the Vicinity of Rivers. The Rock of *Salt*, by the relation of the Workmen, is between 33 and 34 Yards diſtant from the Surface of the Earth. That parcel of it which the Augur brought up was as hard as *Alum*, and as Pure, and when Pulverized became an excellent, fine and ſharp *Salt*. The firſt diſcoverer of it was one *John Jackſon* of *Halton*, about *Lady-Day* laſt, (1670) as he was ſearching for Coals on the behalf of the Lord of the Soil, *William Marbury* of *Marbury* Eſquire.

A Rock of Natural Salt in Cheſhire, *By Mr.* Adam Martindale. n 66. p. 2015

LXXIX. There are two kinds of *Tranſylvanian Stone Salt* : The *Sal Gemma*, and that which is commonly uſed at Table. The latter is found in moſt of the *Salt-Mines*; and is brought in great Quantities down the River *Tibiſcus*, and the Rivers running into it: Some of which is afterwards ſent down the *Danube*, and up the *Morava* to furniſh *Servia*, and the adjacent Provinces; and a great part of it up the *Danube* into *Hungary*. But they bring it no higher; Stone Salt being prohibited by the Emperor, in *Auſtria* who hath a conſiderable Profit upon the boyled Salt brought from *Hallſtadt* in that Province.

The Salt-Mines *in* Tranſylvania *and* Hungary; *By* *Dr.* Brown. n. 58 p. 1[illegible]

I have alſo received an Account, that half an Hour's going from the City *Eperies*, there is a Salt-Mine of great Note; from the firſt place of deſcent unto the bottom, it is about 180 Fathoms deep: Into this the Miners deſcend firſt by Ropes, and at laſt by Ladders, unto the lower parts. The Mine is for the moſt part in an Earthy, and not a Rocky Ground.

The Veins of Salt are large, and there are Pieces to be found of 10000 Pound Weight. They commonly Hew out the Salt into long ſquare pieces of 2 Foot in Length, and one in thickneſs; and for uſe, it is broken and grinded between two Grind Stones.

The Mine is Cold and Damp, but the *Salt* being a *Stone-ſalt*, is not eaſily diſſolved, or at leaſt in any great Quantity, by dampneſs or moiſture: Yet the Water of the Mine is Impregnated with *Salt* in ſuch ſort, that being drawn out in large Buckets, and afterwards boyl'd up, it affords a Blackiſh *Salt*, which they give to their Cattle in the Country.

The Colour of the Ordinary *Stone-ſalt* of this Mine is not very White, but ſomewhat Grey; yet being broken and grinded to Powder, it becomes as White as if it were refin'd. This *Salt* conſiſts of Pointed Parts or *Foſſets*: Another ſort of *Salt* there is, which conſiſts of Squares and Tables; and a Third, to be found of ſomewhat *Stirious* or *Long-ſhoots*.

Nor is all the *Salt* of this Mine of one Colour, but of divers; that which is found groſly mixt with the Earth, receives ſome Colour from it: And even that, which is moſt Pure, and reſembleth *Chryſtal*, doth often receive

Tinctures of ſeveral Colours. In the middle of a Cryſtal Salt with Long Shoots. I have ſeen a delicate Blew; and Count *Rothal* hath a large piece, of a fair Yellow, There are alſo ſome pieces very Clear and Tranſparent, ſo hard that they Carve them into divers Figures, as Croſſes, Crucifixes, and others.

I cannot omit to Advertiſe you, that whereas theſe Salts, though kept without Care, remain'd dry for many Months in other Countries, yet they began ſomewhat to Relent ſoon after I came into *England*; and if they be kept in a Stove, or very Hot Place, they will be apt to loſe their Tranſparency.

Sal Gemmæ Mines in Poland, By .. n.61. p.1099

LXXX. The Mines of *Sal-Gemma* in *Poland*, a Mile diſtant from *Cracovia*, near the ſmall Town of *Wilizka*, which (the Church excepted) is altogether digged hollow under Ground, hath 4 Deſcents: Of which the two Chief being in the Town it ſelf, are thoſe through which the Salt is drawn up; the other two do ſerve for letting down Timber and other Neceſſaries. Theſe Deſcents, or Holes, are ſquare, 4 or 5 Foot long, and as broad, lin'd downwards thorough with Timber. Above, is a great Wheel, with a ſtrong Rope, of the thickneſs of a luſty Arm, drawn about by a Horſe, like as in a Horſe Mill.

He that will Deſcend, muſt cover himſelf with a Frock, and have another Man that faſtens another Rope to the aforeſaid big Rope, and having ſo tyed it about himſelf as to ſit in it, takes one in his Lap and holds him faſt about; whereupon the big Rope being let ſomewhat down, another faſtens likewiſe a piece of Rope to the other thick Rope and does like the former, ſeating himſelf in it and taking and claſping another Man in his Lap, and being alſo let down a little way gives place to others to do the like; in which manner, 30, 40, and more Perſons may be let down all at once; of whom the Firſt having toucht the Ground ſteps out and goes a ſide, the reſt following him and doing the like. And thus they Deſcend to the depth of 100 Fathoms. But then they take a Lamp and lead People about by ſtrange Paſſages and Meanders, ſtill more and more Deſcending, till they come to certain Ladders by which they go down 100 Fathoms deeper, where there are double Paſſages and Holes one above another, in abundance; for the Mine Men dig on ſtill, and cut out every where and on all ſides, as long as the Salt Vein laſteth. The great Holes, to ſecure both the Town above, and the Work below from falling in, are very carefully filled out, and ſupported by ſtrong and well compacted Timber.

Out of theſe Mines they dig and cut out 3 ſorts of Salt, one is Common, Courſe and Black, the Second ſomewhat finer and whiter, the Third very white, and clear like Cryſtal. The courſe and black Salt is cut out in great pieces, roundiſh and 3 *Polonian Ells* long, and one Ell thick, which coſts from 50 to 70 *Polonian Florins*.

Mean time the Inhabitants of *Cracow* have a Privilege, whereby a certain Number of pieces is to be delivered to them, at 8 ſuch Florins the Piece.

The greateſt pieces lie before their Doors, where the Cattle paſſing to and fro, lick off thoſe ſalt Stones, which afterwards by Mills and other Engines are ground and beaten ſmall for uſe. The Colour of theſe ſalt Stones is darkiſh Gray, with ſome Mixture of Yellow.

When this ſalt Work was firſt found, (which is now above 400 Years ago) the *Mine men* which firſt began to work in it were *Germans*; whence the *Poles* have retained the *German* Names of the *Tools*, but given them *Poliſh* Terminations. Theſe *Salt Works* belong to the King of *Poland*, who appoints and maintains the Officers of them; and 'tis one of his beſt *Royal Revenues*, amounting to a conſiderable Sum of Money. There is no leſs than 1000 Men, that are conſtantly employed in theſe Mines; and there was then a Proviſion of *Salt* valued at two Millions.

There are in theſe Works three Horſes, that ſtay always below, having their Stable and other Neceſſaries there: They carry the *Salt* from the places, where 'tis cut and dig'd out, to thoſe whence 'tis, by the above mentioned Wheel and Ropes, drawn up by a Horſe above Ground going round about. The Horſes, after they have been a while under Ground, grow Blind from the ſharpneſs of the *Salt*; and one of them that had been longeſt in thoſe Mines, had the Hoof of his Feet grown as long again, as they are uſually; ſo that each Hoof was near a Span long. This *Salt-Work* hath alſo beneath it certain *Salt-ſprings*, whence the *Salt Water* is by Channels conveyed to ſeveral places, where 'tis boyl'd to Salt.

But there is yet another *Mineral Salt Work* in *Poland*, *viz.* at *Bochna*; but not ſo well Ordered, as the former. Beſides, there are divers other Places in *Poland*, and in *Ruſſia* alſo, which yield Salt; as at *Holuz*, *Colomeja*, *Solum*, *Pintz*, *Oſwentz*, *&c.* In the *Podolian* Deſert, near the River *Boriſthenes*, is a Salt-Lake, whoſe Water is by the heat of the Sun waſted, and turned to Salt, like unto Ice, ſo that the People there ride into it with Horſes and Waggons, and cut it into pieces and carry it away; as the *Poliſh* Hiſtorian *Cromerus* at large relateth; who alſo affirms, That in the aforeſaid *Salt Work* at *Bochna* they find a Frozen Subſtance, which by them is call'd *Carbuncle*, uſed by the People to Purge their Bodies, by Grating and Drinking it in a convenient Vehicle.

The Natron of Egypt *and* Nitrian Water *Examin'd*; *By Dr.* Ch. Leigh. n. 160. p. 609.

LXXXIII. The *Natron* of *Egypt* is an *Alkali Salt* perforated like a Sponge, and of a *Lixivial* Taſte; and thus I find it deſcrib'd by *Pliny*, *Mathiolus*, and *Agricola*.

Its Principles I take to be chiefly two; *viz.* a *Sal-Marine* and an *Urinous Salt*.

That it contains a *Salt-Marine* ſeems manifeſt by theſe Experiments; Firſt, becauſe a *Solution* of the *Natron* has the ſame *Taſte* that a *Solution* of *Salt-Marine* hath; 2*dly* in Evaporation the Particles of the *Natron* incruſtated upon the ſurface of the Water as the Particles of *Sea-ſalt* do in Evaporation. 3*dly* becauſe the *Natron* is *Perforated*, which proceeds (as I ſuppoſe) from a *Sal-Marine*, for that, when it *Cryſtallizeth*, ſhoots with little Cavities. 4*ly* if the *Natron* be mixt with *Salt* of *Tartar*, it emits the ſame Spirit, as *Sal-Armoniack* when mixt with the ſame Salt. And laſtly, that it contains a *Sea-*

ſalt ſeems plain from *Ceſalpinus*, ſays he, *Effloreſcit etiam ſponte non ſolum in* Salinis *ad ſimilitudinem* Lanugenis *Caneſcentis*; *ſed etiam in Vaſis in quibus* Sal *continetur.*

But here it is to be noted, that though the *Nitrian Water* is of a Bluſhy Colour, and makes a briſk *Fermentation* with an *Acid*; yet a Solution of *Natron* looks Clear, and will not *Ferment* with an *Acid*. The Reaſon why a Solution of the *Natron* looks Clear, though the *Nitrian Water*, which is but a Solution of the ſame Salt, is of a Bluſhy Colour, may perhaps be this; I ſuppoſe that the *Water* of *Latron* receives its Redneſs from a Red Clammy ſubſtance, which ſerves chiefly to Cement the two Salts together: And this I the rather Conjecture, becauſe after a Solution of the *Natron* had paſt through a *Filtre*, there ſtuck to it a Red Clammy Matter, and the Solution was Clear. And the Reaſon why a Solution of the *Natron* will not *Ferment* with an *Acid*, I conceive to be this; becauſe that in a Perfect Diſſolution, its Parts being ſeparated one from another by the Parts of the *Water*, their Struglings are too Weak to make an *Effervescency* with an *Acid*, and in this I was further confirm'd by theſe two Experiments. I found that if into a *Solution* of the *Natron*, I pour'd an *Acid*, while the Water look'd whitiſh or diſturb'd the Salt not being perfectly diſſolv'd, it made a briſk *Fermentation*: But when the Water came to be Clear, the Salt then being perfectly diſſolved, if I then poured an *Acid* upon it, it would not *Ferment*. I likewiſe found that this *Solution* being Evaporated to a third part would *Ferment* again.

Its Second Principle I take to be an *Vrinous Salt*; Firſt, becauſe if mixt with *Salt* of *Tartar*, it ſmells like *Sal-Armoniack* when mixt with the ſame Salt. 2*dly* when it was Diſtill'd with *Salt* of *Tartar* in a *Retort*, it afforded an *Vrinous Spirit* as Piercing as the *Spirit* of *Sal-Armoniack*.

The *Sal-Marine* (being a *Foſſile Salt*) I take for granted it Receives from the Earth, but it ſeems to have its *Volatile Alkali* from the Air; Firſt, becauſe it's ſaid by *Pliny*, *Spumam* Nitri (which is the *Natron* here ſpoke off) *Antiqui negabant fieri niſi cum* Ros *cecidiſſet*. By M. *de la Chambre* it is affirmed, That three or four Days before the *Nile* begins to Overflow, there falls a certain Dew which hath a Fermenting Vertue, and leavens a Paſt expos'd to the Air, and at the ſame time ſaith *Pliny*, and M. *de la Chambre* the *Nitre* Pits grow full of *Nitre*. And *Sands*, *Vanſlebius*, and ſeveral ſay, that though 500 in a Day die in *Grand Cairo* of the Plague before the beginning of the Inundation of the *Nile*, yet the very Day after, there does not one die; which doubtleſs could not proceed from any other Reaſon, than becauſe at that time, the Air was Impregnated with this *Volatile Alkali*; for at that time the *Nitre-Pits* grow full and this Dew falls. This, I think, may ſufficiently hint to us the great uſe of its *Volatile Spirit*, eſpecially in Peſtilential Diſtempers, Laſtly, about that time that the *Nile* begins to O'erflow, thoſe Specimens which we had here at *Oxford* grew heavier by being expoſed to the Air.

Here it is to be noted, that this *Alkali* is not made ſo by Fire: I cannot therefore conclude with *Helmont* that all *Alkalies* are made ſuch by that Element.

The Learned Dr. *Huntington* (who was at *Nitria*,) gives this Account of its ſeparation from the Water in *Latron*.

There is a Town in *Ægypt* called *Nitria*, which gives Name to the *Nitrian Deſert*, where there is a Lake called *Latron*, taking up an Area of 6 or 7 Acres, ſituate about 30 Miles W. b S. from *Terana*, a Town lower upon the *Nile* than *Grand Cairo*, and about the ſame diſtance N. W. from the *Pyramids*; from the bottom of this Lake, this ſort of *Nitre* called *Natron*, ariſeth to the Top (as they do apprehend) and there by the heat of the Sun Condenſes into this kind of ſubſtance. That all the *Nitre* comes from the Bottom to the Top, I dare not affirm, and ſhall therefore premiſe ſome *Phænomena* which it afforded in Evaporation, before I give you my Conjecture about it.

I took an *Evaporating Glaſs* which held about 4 Ounces, and poured into it 2 Ounces of the *Nitrian Water*, this I ſet upon a Sand Furnace, giving it Fire by Degrees; as ſoon as the Water was warm, the Particles of the *Nitre* began to ſwim upon its ſurface in ſtragling and uneven Numbers, theſe, after a while, united, and at laſt there aroſe Salt ſufficient to cover the whole Superficies of the Water; I took then a thin Glaſs and skim'd off this Ice, but could ſcarce take it all off, before it was ſeconded by another, and thus the Salt did riſe ſucceſſively in Films, as long as there was any Water in the Glaſs; theſe Films had the Colour and Taſte of the *Nitre* which came from *Nitria*, and did like it *Ferment* with an *Acid*. And theſe are they which by *Pliny* are called *Flos Salis*, and if I miſtake not the ſame with that which *Herodotus* ſays, they make their *Mummy* with. If therefore by the Languiſhing Heat of a *Digeſting Furnace*, the *Nitrous* Particles could ſeparate themſelves from the Water, and over that ſpread themſelves in an Ice, it may be as probable, that by the greater Heat of the *Sun*, the *Nitre* of *Latron* is ſeparated from the Water after the ſame Manner. And as in the Evaporation of other Mineral Waters, when the Water is not ſtrong enough for to hold up the *Salt*, it is generally cover'd with a thin Film. So I ſuppoſe in Evaporation of the *Natron*, ſome Parts of the Water being flown away, the Particles of the *Sal Marine* branch one into another, and ſo Incruſtate upon the ſurface of the Water.

In this *Hypotheſis* I was the farther Confirm'd by this Experiment; I took ſome of the *Natron* and diſſolv'd is in Water, and ſet it to Evaporate: And I found that the *Salt* did not incruſtate upon the Water, till 3 Parts of the Water was Evaporated. It did not therefore ſeem probable that the *Nitre* came all from the Bottom to the Top, and ſo was Condenſed by the Heat of the *Sun*; but that they Incruſtated, when the *Saline Particles* Branch'd one into another, ſome of the Aqueous Parts being Exhaled.

The Reaſon why its *Volatile Alkali*, in Evaporation, does not fly quite away, is becauſe it is held there by the *Sal Marine*.

By the Teſtimony of *Hippocrates*, *Gallen*, *Mathiolus*, *Diaſcorides*, *Pliny*, and *Agricola*, it appears to have been of great uſe in *Phyſick*. But here it is to be Noted, that when *Nitre* is preſcribed by them, that *Nitre* which is an Ingredient of *Gun-Powder*, is not to be underſtood.

Amongſt the *Moderns* we have this Account of it; M. *de Cles* is of the Opinion that moſt of the *Mineral Waters* in *France* are Impregnated with this ſort of *Nitre*, and that all their Cures are done by it.

Molenbrochius affirms a *Tincture* of *Aphronitrum* to be of Wonderful Efficacy in Stone. This I the rather Credit, becauſe it's ſaid by *Junken*, in his *Medicus* the *Nitre* of *Nitria* is of ſo piercing a *Spirit*, that it doth not permit either Stone or Rock to be thereabout.

In Treating of its uſe in *Agriculture*, I think it convenient to Premiſe one *Phænomenon* which is afforded in *Evaporation*; when the Salts had ſpread themſelves over the Water in an Ice thoſe thin Plates after a while would bread and aſcend in Perpendicular Lines to the very Top of the Glaſs; I do therefore conjecture, that *Nitre* may be ſaid to *Fertilize* the Ground after this Manner; it's *Volatile* Particles being Heated by ſome *Subterraneous Fire*, or elſe by the Warmth of the Sun, they do quickly Aſcend in the ſmall *Tubes* of the *Plant*, and ſo by their *Elaſtick* Nature, carry along with them, or force before them, thoſe Particles which as they differently Convene together, Conſtitute the different parts of the *Plant*.

Mund. Subter Cap. de Nitro. But this Conjecture will be made ſomething the more probable, by an Experiment in *Kircher*; where he ſays, if you take a Wooden Tube, and put into it *Tartar*, *Quick lime*, *Salt*, and the *Urine* of a *Wine-Drinker*, reduced into one Maſs, which is to be hardned in the Sun; and after that ſet it in a Cold Cellar, by the help of *Sal-Petre* from the before mentioned Maſs, you will, not without Admiration, ſee Flowers branch out of it. Yea ſuch is the Force of *Nitre*, that if in a Glaſs kept cloſe ſhut, you put the Juices of ſome *Nitrous-Herbs* on the before mention'd Maſs, the *Nitre* contain'd within it, being Pregnant with Spirit, will Force it ſelf through the very *Pores* of the *Glaſs*.

M. *De la Chambre* ſays, *Plants* do grow in *Ægypt* in ſuch Abundance that they would Choak one another, if they were not hindred by throwing Sand upon the Fields; inſomuch that the *Ægyptians* muſt take as much Pains to leſſen the Fatneſs of their Land, as other Nations do to Encreaſe the Fatneſs of it.

Cap de Vitri *Juvent.* In *Mechanicks* we have this Account of it: It's ſaid by *Pliny*, that a Company of Merchants being thrown upon a Shore where there were not any Stones to be found, were forced to take great Pieces of *Ægyptian Nitre* out of their Ships, and make Walls, upon which they hung their Boyling Kettle: The *Nitre*, being heated by the Fire, mixt with the Sand, and ran into ſeveral ſtreams of Glaſs, which afterwards hinted the way of making Glaſs. It is likewiſe of uſe in Dying, for *Pliny* and *Vitruvius* affirm, that by the help of this, the true *Azure* is made; and that without this, there cannot be a true Shadow.

This *Nitre* is diſtinguiſh'd from *Salt-Peter*; *Firſt*, by its *Fermenting*: It will *Ferment* with any *Acid*, but *Salt-Petre* will not. I found that it would *Ferment* with *Vinegar* as the old Commentators obſerve in their Comments upon *Jeremiah* and the *Proverbs*, but *Salt-Petre* will not: Which gave Occaſion to ſome, in thoſe Texts, to alter the Word *Nitre*.

2. It may be diſtinguiſh'd from *Salt Petre* in its Taſte; for *Natron* hat. *Lixivial* Taſte, but the other not.

3. By the *Volatile Spirit* which it affords: For from the one comes over a *Volatile Alkali*, but from the other a *Corroſive Acid*.

4. The *Natron* affords a Red Clammy Subſtance, Inſipid, but the other not. This Clammy Subſtance (if I miſtake not) is that which by *Pliny* is call'd *Ærugo Salis*: This it hath from the Earth, and therefore it is again ſaid by *Pliny*, *Sunt ibi* Nitrariæ *in quibus &* Rulum *exit a Colore* Terræ.

5. Like *Salt Petre* it will not *Cryſtallize*.

6. In the Fire, it makes no *Detonation*.

But in this it reſembles *Salt Petre*; as that by the Flowers of Sulphur is made into a *Sal Prunella*, ſo this, if you drop *Spirit* of *Sulphur* upon it, ſhoots into *Pyramidal Salt*, that is not by the Taſte diſtinguiſhable from *Sal Prunella*, though its Taſte before was *Lixivial*.

From *Sal-Armoniack* it may be diſtinguiſhed; Firſt, by its Colour, for the *Natron* is Reddiſh, the other not. Secondly, by the Texture of its Parts: In *Sal-Armoniack* the Parts ſeem Cloſe and firmly knit together, but the *Natron* is Spongy and Perforated. Thirdly, If mixt with *Sal-Armoniack* the *Sal-Armoniack* Emits the ſame Spirit, as it doth when mixt with *Quick Lime*.

But I think it comes much nearer to the Nature of *Sal-Armoniack*, than *Salt-Petre*; Firſt, becauſe it is compos'd of a *Sea-ſalt* and an *Urinous Alkali*; 2*dly*, Like *Sal-Armoniack* when diſſolved in Water, it makes it extreamly Cold: And, as *Franciſcus Hernandez* ſays, It produces the ſame Effect when diſſolved in Wine.

Hiſt. of Mexico.

2. The *Nitre* of *Egypt*, by the Experiments made about it at *Oxford*, plainly appears to be little different from *Sal-Armoniack*: And conſidering, that it Rains little or nothing, comparatively to the great Heats, in *Egypt*: And that the Lakes there are only once a Year furniſh'd with freſh Water from the Overflowings of the *Nile*; alſo that vaſt Tracts of Land there, and all over *Aſia*, are naturally cover'd with *Foſſile Salt*; again, that thoſe Lakes are furniſh'd with vaſt Animals, as *Crocodiles*, *Hippopotami*, and without doubt great variety of other leſſer Vermine; theſe things, I ſay, well conſider'd, it is eaſie to think, that in a Years Time, moſt of the Salt Water of thoſe Lakes has paſt through the Bodies of thoſe Animals, and conſequently is become *Urinous*, or *Saline Urinous* as is the Nature and Compoſition of *Factitious Sal-Armoniack*.

The Original *of the* Nitre *of* Egypt, *By Dr.* Liſter. n. 167. p. 837

LXXXII. I am convinced that Sulphur is ſublimed from the Pyrites according to the Opinion of Dr. *Liſter*, eſpecially that gathered upon Mount *Ætna*, *Veſuvius*, the *Solfatara*, and in the Stoves of St. *Gennaro*, not far from thence, for moſt of the Stones and Cynders, thrown out of thoſe mighty Furnaces, do manifeſtly contain Iron, if we may believe the *Magnet*. As to the Salt (taken by many Writers to be a ſort of *Sal-Armoniack*) found together with the *Sulphur* in the forementioned Places, it appeared to me to be a kind of *Nitrum Calcarium*; for, as I remember, it had not any *Urinous* Qualities,

The Pyrites *and* Lapis Calcarius, *conſider'd*; *By Dr* Tanc. Robinſon. n 169. p. 924

Qualities, that I could perceive by ſlight Tryals of Mixture; and I was the more confirmed in my Opinion after I had ſeen, and conſider'd, the great Quantity of Lime-ſtone round about *Naples*; many Beds of it lying up and down the *Terra di Lavoro*, or *Compania Felice*.

The Spontaneou Firing *of the* Pyrites, *By Dr.* Fred. Slare. n.213.p.518

LXXXIII. The Maſter of a *Copperas* Work at *Whiteſtable* in *Kent*, having Engroſs'd all the *Pyrites* or *Copperas-ſtones* to himſelf, laid up Two or Three Hundred Tun in a Heap, and built a Shed over it to keep off the Rain: But in the ſpace of 6 or 7 Months it firſt ſmoaked, and then took Fire, and burnt for a Week. Some of it looked like melted Metal, and other parts like Red hot Stones; and it diſcharged ſo Fœtid, Sulphurous, or ſtinking Exhalations, that the People in the Neighbourhood were miſerably afflicted, and forced to uſe all their Endeavours to Extinguiſh it.

A Mineral *at* Liege, yielding Brimſtone *and* Vitriol. *By* Sir Rob. Moray. n. 3 p.45.

LXXXIV. The *Minerals* out of which Brimſtone and Vitriol are Extracted is one and the ſame, not much unlike Lead Ore, having alſo oftentimes Lead mingled with it, which is ſeparated from it by picking it out of the reſt. The Mines reſemble our *Engliſh* Coal Mines, dug according to the depth of the *Mineral*, 15, 20, or more Fathoms as the Vein leads the Workmen, or the Subterranean Waters will give them leave.

To make Brimſtone, the break the Stone or Ore into ſmall Pieces, which they put into *Crucibles*, made of Earth 5 Foot long, Square and Pyramid-wiſe; the Entry is near ½ a Foot ſquare. Theſe *Crucibles* are laid ſloping, eight undermoſt, and ſeven above them, as it were betwixt them, that the Fire may come at them all, each having its particular Furnace or Oven. The Brimſtone being diſſolved, by the violence of the Heat, drops out at the ſmall end of the *Crucible*, and falls into a Leaden Trough or Receptacle, common to all the ſaid *Crucibles*, through which there runs a continual Rivulet of cold Water, conveyed thither by Pipes, for the Cooling of the diſſolved *Sulphur*, which is ordinarily 4 Hours in Melting. This done, the Aſhes are drawn out with a crooked Iron, and being put into an Iron Wheelbarrow, are carried out of the Hutt, and being laid in an Heap, are covered with their other Elixed or drained Aſhes, the better to keep them warm; which is Reiterated, as long as they make Brimſtone.

To make *Coperas* or *Vitriol*, they take a quantity of the ſaid Aſhes, and, throwing them into a ſquare planked Pit in the Earth, ſome four Foot deep and eight Foot-ſquare, they cover the ſame with Ordinary Water, and let it lie 24 Hours, or untill an Egg will ſwim upon the Liquor, which is a ſign that it is ſtrong enough. When they will Boyl this, they let it run through Pipes into the Kettles, adding to it half as much *Mother-Water*, which is that Water that remains after the Boyling of the *Hardned Copperas*. The Kettles are made of Lead, 4½ Foot high, ſix Foot long, and three Foot broad, ſtanding upon thick Iron Bars or Grates. In theſe the Liquor is Boyled with a ſtrong Coal Fire twenty four Hours or more; according to the ſtrength or weakneſs of the *Lee* or *Water*. When it is come to a juſt Conſiſtence, the Fire is taken away and the boyl'd

Liquor ſuffered to Cool ſomewhat, and then 'tis tapp'd out of the ſaid Kettles through Holes beneath in the ſides of them, and Conveyed through Wooden Conduits into ſeveral Receptacles, three Foot deep and four Foot long (made and ranged not unlike our Tan-Pitts,) where it remains 14 or 15 Days, or ſo long till the *Copperas* ſeparates it ſelf from the Water, and becomes Icy and hard. The Remaining Water is the above mentioned *Mother-Water*; and the Elixed or Drained Aſhes are the Dregs or *Caput Mortuum*, which the *Lee*, whereof the *Vitriol* is made, leaves behind it in the Planked Pits.

Sulphur. Vitriol. Alum, *and* Minium, *from a Stone in* Sweden; *By Sir* Gilb. Talbot. n. 21. p. 375. *Fig* 153.

LXXXV. 1. There is a *Stone* in *Sweden* of a Yellow Colour intermixed with ſtreaks of White, (as if compoſed of Gold and Silver) and heavy withal. It is found in firm Rocks, and runs in Veins, upon which they lay Wood, and ſet it on Fire. When the *ſtone* is thus heated, they caſt Water upon it, to make it Rend, and then dig it up with Mattocks. This done they break it into ſmaller pieces, and put it into Iron Pots, of the ſhape Repreſented by *Fig*. 153. the Mouth of the one going into the other. Theſe they place, the one in the Oven upon an Iron Fork ſloping, ſo that the *ſtone* being melted, it may run into the other, which ſtands at the Mouth of the Oven, ſupported upon an Iron. The firſt running of the *ſtone* is *Sulphur*.

The Remainder of the Burned-ſtone is carried out, and laid upon a high Hill, where it lies expoſed to the Sun and Air for the ſpace of two Years; and then taketh Fire of it ſelf, caſting forth a thin blue Flame, ſcarce diſcernable in the Day-time. This being conſumed, leaveth a blue Duſt behind it; which the Workmen obſerve, and mark with Wooden Pins. This they dig up, and carry into the Work-houſe, and put it into great *Tubs* of *Water*, where it infuſeth 24 Hours, or more. The *Water* they afterward Boyl in Kettles as we do *Salt-Peter*, and put it into Cooling Tubs, wherein they place Croſs Sticks, and on them the *Vitriol* faſtens, as *Sugar-Candy* doth.

The *Water* that Remains, after the Extraction of the *Vitriol*, they mix with an 8*th* part of *Urine* and the *Lees* of Wood Aſhes, which is again boyled very ſtrong, and being ſet to Cool in Tubs, Croſs Sticks are likewiſe faſtened and thereon the *Alum* faſtens.

In the Water, which remains after the *Alum*, is found a *Sediment*, which being ſeparated from the Water, is put into an Oven, and Wood laid upon it and Fired, till it become Red, which makes the *Minium*, wherewith they Paint their Houſes, and make Plaiſter.

The ſame in England; *By* . . . ib. p. 376.

2. There is a kind of *ſtone* in the North of *England*, yielding the ſame ſubſtances, except *Minium*.

Green Copperas *Works*; *By Mr.* Daniel Colwal. n. 142. p. 1056.

LXXXVI. *Copperas ſtones*, which ſome call *Gold ſtones*, are found on the Sea ſhore in *Eſſex*, *Hampſhire*, and ſo Weſtward. There are great Quantities in the Cliffs; but not ſo Good as thoſe on the ſhore, where the *Tides* Ebb and flow over them.

The beſt of them are of a bright ſhining Silver Colour; the next, ſuch as are of a Ruſty deep Yellow; the worſt ſuch as have Gravel and Dirt in them, of a ſadder *Umber* Colour.

In the midſt of theſe Stones, are ſometime found the Shells of *Cockles*, and other ſmall *Shell Fiſhes*; ſmall Pieces of the Planks of Ships, and Pieces of Sea-Coal.

In order to the making of *Copperas*, they make Beds according as the Ground will permit; thoſe at *Deptford*, are about 100 Feet long, 15 Feet broad at the top, and 12 Feet deep, ſhelving all the way to the bottom.

They Ram the Bed very well, firſt with ſtrong Clay, and then with the Rubbiſh of *Chalk*, whereby the Liquor, which drains out of the Diſſolution of the Stones, is conveyed into a Wooden ſhallow Trough, laid in the middle of the Bed, and covered with a board; being alſo boarded on all ſides, and laid lower at one end than the other, whereby the Liquor is conveyed into a Ciſtern under the Boiling Houſe.

When the Beds are indifferently well dryed, they lay on the Stones about 2 Feet thick.

Theſe Stones will be five or ſix Years, before they yield any Conſiderable Quantity of Liquor; and before that, the Liquor which they yield is but weak.

They Ripen by the Sun and Rain: Yet Experience proves, that Watering the Stones, although with Water preparing by lying in the Sun, and poured through very ſmall Holes of a Watering-Pot, doth retard the Work.

In Time theſe Stones turn into a kind of *Vitriolick Earth*, which will ſwell and Ferment like Leavened Dough.

When the Bed is come to Perfection, then once in four Years they Refreſh it, by laying New Stones on the top.

When they make a New Bed, they take a good quantity of the old Fermented Earth, and mingle it with New Stones, whereby the Work is haſtened. Thus the Old Earth never becomes uſeleſs.

The Ciſtern before mentioned is made of ſtrong Oaken Boards, well Joynted and Calked. That at *Deptford* will contain 700 Tuns of Liquor. Great care is to be taken, that the Liquor doth not drain through the Beds, or out of the Ciſtern. The beſt way to prevent the ſame, is to divide the Ciſtern in the middle, by Oaken Boards, Calked as before; whereby one of them may be mended in caſe of a Defect.

The more Rain falls, the more, but the Weaker will be the Liquor: The Goodneſs whereof is tryed by Weights prepared for that purpoſe; Fourteen Penny Weight, is Rich: Or an Egg being put into the Liquor, the higher it ſwims above the Liquor, the ſtronger it is. Some times the Egg will ſwim near half above the Liquor.

Within one Minute after an Egg is put in, the ambient Liquor will boyl and froth; and in Three Minutes the Shell will be quite worn off.

A Drop of this Liquor falling on the Manufactures of *Hemp*, *Flax* or *Cotton Wooll*, will preſently Burn a Hole through it. As alſo in *Woollen* and *Leather*.

Out of the aforeſaid Ciſtern, the Liquor is Pumped into a Boiler of Lead, about 8 Feet ſquare, containing about 12 Tuns, which is thus ordered. Firſt they lay long Pieces of Caſt Iron, 12 Inches ſquare, as long as the Breadth of the Boiler, about 12 Inches one from another, and 24 Inches above the Surface of the Fire. Then Croſs-wiſe they lay ordinary Flat Iron Barrs, as cloſe as they can lie, the ſides being made up with Brick work. In the middle of the bottom of this Boiler is laid a Trough of Lead, wherein they put at firſt 100 Pound Weight of Old Iron.

The Fewel for Boiling is *Newcaſtle-Coals*. By degrees in the Boiling, they put in more Iron, amounting in all to 1500 Pound Weight in a Boiling As the Liquor Waſtes in Boiling, they Pump in Freſh Liquor into the Boiler: Whereby, and by a Defect in ordering the Fire, they were wont to be above 20 Days before it was Enough; when that is, they Try, by taking up a ſmall Quantity of Liquor, into a ſhallow Earthen Pan, and obſerving how ſoon it will gather and Cruſt about the ſides thereof. But now of late by the Ingenious Contrivance of Sir *Nicholas Criſp*, the Work is much Facilitated. For at his Work at *Deptford*, they boil off 3 boilers of Ordinary Liquor in one Week; which is done, Firſt by ordering the Furnace ſo, as that the Heat is conveyed to all Parts of the bottom and ſides of the Furnace.

Then, whereas they were wont to Pump Cold Liquor into the Boiler to ſupply the Waſte in Boiling, whereby the Boiler was Checked ſometimes 10 Hours, Sir *Nicholas* hath now a Veſſel of Lead, which he calls a Heater, placed at the end of the Boiler, and a little higher, ſupported by Bars of Iron as before, and fill'd with Liquor, which by a Conveyance of Heat from the Furnace, is kept near Boiling Hot; and ſo continually ſupplies the Waſte of the Boiler, without hindring the boiling. *Thirdly*, by putting due Proportions of Iron from time to time, into the Boiler; As ſoon as they preceive the Liquor to boil ſlowly, they put in more Iron. which will ſoon Quicken it. Beſides, if they do not continually ſupply the boiling Liquor with Iron, the *Copperas* will gather to the Bottom of the Boiler and melt it; And ſo it will do if the Liquor be not preſently drawn off from the Boiler into a Cooler, ſo ſoon as it is Enough.

The Cooler is Oblong, 20 Feet long, 9 Feet over at the top, 5 Feet deep, taper'd towards the Bottom, made of *Tarras*. Into this, they let the Liquor run, ſo ſoon as it is boil'd Enough. The *Copperas* herein will be Gathering or Shooting 14 or 15 Days: And gathers as much on the ſides as in the Bottom; *ſc.* above 5 Inches thick. Some put Buſhes into the Cooler, about which the *Copperas* will gather: But at *Deptford* they make no uſe of any.

That which ſticks to the ſides, and to the Buſhes, is of a Bright Green, that in the Bottom of a Foul and Dirty Colour.

In the end of 14 Days, they Convey the Liquor into another Cooler, and Reſerve it to be boiled again with New Liquor.

The *Copperas* they Shovel on a Floor adjoyning: So that the Liquor may drain from it into a Cooler.

The Steam, which comes from the Boiling, is of an Acrimonious ſmell.

Copperas may be boiled without Iron, but with Difficulty; without it the Boiler will be in danger of Melting.

Sometimes in ſtirring the Earth upon the Beds, they find pieces of *Copperas*, produced by lying in the Sun.

Oyl of Vitriol *Increaſing* in Weight, By Dr. Wil. Gold. n. 356, p. 496. LXXXVII. Some Druggiſts have accidentally taken notice of an Increaſe of Weight in *Oyl* of *Vitriol* expoſed to the Air (and perhaps have improv'd it to their own Gain, though to the Detriment of the Buyer.) And the Induſtrious Chymiſt Mr. *White*, the Univerſity Operator at *Oxford*, had a Viol of that Liquor unſtopt and conſtantly running over: But ſince from thence no true Eſtimate of the *Juſt Increaſe* could be collected, I ſhall here give you what has occur'd more particularly on this Subject.

Vid. Sud. Cap. I. §. XVI. *Nov.* 4. 1683. Three Drams of *Oyl of Vitriol*, ſo far *Dephlegm'd* as to Burn or *Corrode* a ſtrong Packthred aſunder, was expoſed to the Air in a Marmalade Glaſs of three Inches Diameter, and placed in a Nice pair of Scales, in a Room where no Fire nor Sun came; it's Increaſe for ſeven Natural Days, divided by leſs Portions of Time, was according to the following Table.

Nov: 1683		*Gain.*	*Space of Time.*	*Weather.*	*Wind.*	*Summ of Gain.*	*Natural Day.*
D.	*H* 3	ʒ ℈. gr.	*H.*	*Moiſt.*		ʒ ℈. gr.	
9	5. *p. m*	3 0 0					
10	11 *p. m.*	0 0 19	6. *h.*	*Moiſt and*	*Southerly*		
	8. *m.*	0 1 12	9	*Windy.*	*N. Weſterly.*		1*ſt.*
	11 *m*	0 0 08	3	*Rainy Morn*		1 0 8	
	5. *p. m.*	0 0 09	6	*Clear.*			
11				*Star lig. Cold.*			
	11 *p. m*	0 0 18	6	*Bright Morn*	*N. W.*	0 2 18	2*d.*
	8. *m.*	0 1 07	9	*Mild.*			
	11. *m.*	0 0 04	3	*Mild, Dry*			
	5 *p. m.*	0 0 09	6	*Weather.*			
12	11 *p. m.*	*fere* 0 10	6	*Mild, Dry*	*N. W.*		
	8 *m.*	0 0 17	9	*Clear Morn.*	*N.*	01 19	3*d.*
	11 *m.*	0 0 05	3	*Froſty.*	*N. more.*		
	5 *p m.*	0 0 07	6	*Overcaſt.*	*W.*		
13	11 *p m.*	0 0 06	6	*Cloudy Rain*	*Weſterly.*		
	8 *m.*	0 0 09	9				
	11 *m.*	0 0 03	3	*Cloudy.*	*S. W.*	0 1 3½	4*th.*
	5 *p. m.*	0 0 05½	6	*Mild.*			

14	11 *p. m.*	0 0 06	6	*Cloudy Miſty*	*S. E.*		
	8 *m.*	0 0 08	9	*Cloudy Miſt.*		0 0 18	*5th.*
	11 *m.*	0 0 02½	3	*Miſty.*	*Southerly.*		
	5 *p. m.*	0 0 01½	6	*Very Warm*			
15	11 *p. m.*	0 0 02	6	*Cloudy, unuſually Warm.*	*More S.*	0 0 15	
	8 *m.*	0 0 06	9	*Cloudy.*	*S E.*		*6th.*
	11 *m.*	0 0 03	3	*Cloudy Moiſt.*	*More S.*		
	5 *p. m.*	0 0 04	6	*Clear Coldiſh.*	*Eaſterly*		
16	11 *p. m.*	0 0 04½	6	*Dry Star light Cold, Cloudy*	*Eaſterly.*		
	9 *m.*	0 0 09	10	*but Cold.*		0 0 17	*7th.*
	11 *m.*	0 0 02	2	*Cloudy Windy.*	*S. E.*		
	5 *p. m.*	0 0 02	6	*Cl. very Mild*			

From the 16*th.* in the ſucceſſive ſpaces of 24 Hours, each Gain'd one of the Number of Grains following; as the 8*th.* Natural Day Gained 13½. The Next, 12. 9. 7. 6. 5. 5. 4½. 3. 3. 3 3 4. 3 (*Decem*) 4. 4½ 4. 3 3. *&c.* ſtill irregularly deceaſing till the Liquor was ſatiated. The *Diary* was continued to *Jan.* 4. 168¾. when the Increaſe, in 24 Hours, amounted ſcarce to half a Grain and probably had the Weather been then Dry, it might have been none at all; or rather the Liquor might have loſt what before it had gained.

Hence 'tis Obvious that the more our Liquor was Saturated, the leſs was its daily Increaſe, though not gradually leſs by an Even deſcent each Day, but ſometimes two or more Natural Days together, it was exactly the ſame, a Day or two after leſs, and then again more the next Day following, according as the Liquor ſtood affected by the Heat and Cold, Dryneſs or Moiſture of the Weather, the differing time of the Day, and Quarter of the Wind. Thus upon the view of the whole Diary of almoſt two Months, it appear'd, the Increaſe was more in a Moiſt, Rainy, Miſty, and Snowy, but leſs in a Froſty, Clear, and Dry Seaſon; as alſo it was more in a Cold than in a Warm Air. When the Wind was Northerly or Eaſterly the Gain was leſs *cæteris paribus*, than when Southerly or Weſterly, and was leſs in the Day than in the Night. The Primary Cauſe of this *Phænomenon* ſeems to be the Moiſture of the Air, which our Liquor (a Potential Fire) imbibes as greedily, as Actual Fire does the *Pabulum* of *Nitre*, yet we muſt allow that all the other Circumſtances of Seaſon juſt now mention'd have each their particular influences in Diverſifying the Quantity of the Increaſe. Thus it appears in the Table, that Heat alters the Progreſs of Increaſing: For on the 14 of *Nov.* from 11 *m.* to 11 *p. m.* (at which time, ſpecially towards Night) a very unuſual and troubleſome Heat in the Air was complained of by ſeveral here in *Oxford*; in 12 Hours the Gain was only 3½ *gr.* whereas in the like Time preceding, it was 10½ Grains, and in that juſt following 9 Grains.

Neither indeed can any thing otherwiſe be expected from Heat, ſince thereby the Moiſture might rather be Exhal'd; or at leaſt might be ſuſpended, agitated and intimately mixt with the Subſtance of the Air, and conſequently not ſo eaſily be Arreſted and Entangled by the Surface of the Liquor, as when the Air is leſs hot. However, allowing the Effect of this *Anomalous* Accident at a Time of the Year when leaſt expected, and conſidering that moſt commonly Heat keeps even Pace with the Seaſon of the Year, depending as to its Temper for the moſt part on the Nearneſs or Remoteneſs of the Sun, we may ſafely conclude Moiſture the chief and only Cauſe of the Increaſe of Weight in *Oyl* of *Vitriol*, ſince in Dry, Clear Weather, it conſtantly increaſes leſs than in Moiſt and Cloudy; the Circumſtance of Heat or Cold remaining the ſame in both.

But this will be clearly evinc'd by an Inquiry made into the Nature of the Subſtance gain'd with the Increaſe of Weight: For by the ordinary ways of Tryal it appear'd, the *Atmoſphere* afforded our Liquor nothing beſides ſome of its *Watry Particles*, wherewith it always abounds; but more eſpecially is ready to part with in Moiſt Weather.

The Air, without doubt, has great Variety of different Subſtances floating in it, whereof ſome Particles do Adhere to this, ſome other ſort to that Body, according as either is peculiarly diſpos'd to receive one ſort rather than another. Thus the Mortar in the Joints of Old Walls and Vaults, from Corpuſcles attracted from the Air, Spouts out and Frames a peculiar kind of Salt. I have known a Deal Shelf, moiſten'd only with the Liquor of *Fixt Nitre*, Froſted over with *Cryſtals* of a perfect *Inflammable Nitre* by Regaining the proper *Acids* from the Air, all one as if ſo much Spirit of *Nitre* had been pour'd on the ſaid Liquor. I have ſeen a Viol half fill'd with *Oyl* of *Tartar per Deliquium* (by being left open to the Air) beſet above the Liquor with peculiarly Figur'd Cryſtals, and at the bottom were Flat Cryſtalliz'd Plates of a Salt which without Flame Crackled on a live Coal, and left behind a *Calx* much like Dr. *Liſter's Nitrum Calcarium*. And 'tis well known *Colcothar* of *Vitriol* Reimpregnated by the Air, will by a freſh Diſtillation give you its proper *Acid* as at firſt. Now upon ſuch hints as theſe, ſome (fond of the Doctrine of *Alcali* and *Acid*) might perhaps expect, ſince differing Bodies of an *Alcalizate* Nature do thus regain their proper *Acids*, that *Vice verſa* even this moſt *Acid* Liquor, *Oyl* of *Vitriol*, alſo might find its *Alcalizate* Aſſociate in the Air, from which the Violence of Fire had before driven it: But we could diſcover no ſuch Matter; the Taſte of our Augmented Liquor was ſtill purely *Acid* and only weaker than before, whereas it would have been Saltiſh had an *Alcali* been Combin'd with it; and its Colour from a deep Reddiſh, became *Limpid*, all one as if the like Quantity of fair Water had been mixt. But to be more certain in this Point, I Diſtill'd off the New Gain'd Subſtance: At firſt it came over as Inſipid as clear Water; and urging the Fire farther, the Drops prov'd Sower, and the remaining *Oyl* in the *Retort* was altogether as *Corroſive* as at firſt. Whence we may Infer, its Edge was not at all blunted by any adjoyned *Alcali*: So that what the Air afforded was nothing elſe but mere *Water* only.

As to the quantity of the whole Increaſe, it can't be determin'd by any general Rule, ſince it varies according to the different Strength of the *Oyl* of *Vitriol*; for it appears by the *Table*, the more diluted the Liquor, the leſs attractive it prov'd. This here employ'd, (as highly dephlegm'd, I preſume, as any uſually is) gave a Triple, and more than $\frac{1}{6}$ of its firſt Weight, amounting in all from 3 to 9 *Drams*, and 30 *gr.* before it come to a Stand.

Which Proportion of *Increaſe* I found confirmed in leſſer Quantities alſo; as 3 *gr. increas'd* to more than 9 *gr.* and *one Grain* gave the *Weight* of ſomething more than 3 *Grains*. But beſides the Strength of the Liquor, there are other Circumſtances, as the Seaſon of the Year, and Poſition of the Place, which will certainly ſomething alter this Point; thus our Liquor will gain more in *Winter* than in *Summer*, more in a *Cellar* and *ſunleſs Room*, than in a Room not ſo *Qualify'd*.

All theſe Circumſtances, which relate to the Quantity will alſo influence very much the Time of the *Increaſe*, but that which makes the moſt peculiar and principal Variation in this point, is the *Proportion* of the *Surface* to the *Bulk* of the *Liquor*. For I find the greater or leſs the *Surface* is, the quicker or ſlower the *Encreaſe*. Thus 3 *Grains* dropt and diffus'd to near $\frac{1}{4}$ Inch breadth on a piece of Glaſs, gain'd 3 *Gr.* in 6 Hours; one *Gr.* in 6 more; *one Gr.* and $\frac{1}{2}$ in 12 Hours more, in the next 12 Hours it gain'd $\frac{1}{2}$ a *Gr.* and in the laſt 12 Hours it gain'd very little obſervable, ſo that in leſs than 48 Hours, having more than triple its firſt Weight, it was for ſome Time fully ſatiated, till rainy Weather added ſomething more.

But to diſcover more nicely what Intereſt the Proportion of Surface has in haſtening or retarding the Increaſe of *Weight*, I expos'd in the ſame Room, and to the ſame Temper of the *Air* (as near as I could gueſs) 3 Drams of the ſame *Oyl* of *Vitriol* in an open flat Glaſs one Inch broad, being only $\frac{1}{3}$ of the *Diameter* of that Glaſs uſed at firſt with the like Quantity. The Reſult was this, that whereas the other Surface of 3 Inches *Diameter* gain'd (as in the *Table*) near 19 *Gr* the firſt 6 Hours, this leſs ſurface gain'd a very little perceivable more than 2 Grains in the ſame ſpace of Time. Now ſince the *Area's* of *Ciroles* are to one another as the ſquares of their reſpective Diameters; as *One* the ſquare of the leſs, is to 9, the ſquare of the greater Glaſſes Diameter, ſo was the Weight of a little more than 2 Grains gain'd in the narrower Glaſs, to near 19 *Gr.* gain'd in the broader; Wherefore the *Time* of Increaſing bears, as near as can be expected, an exact Proportion to the ſurface of the Liquor expos'd; and the Liquor in the leſſer Glaſs having but $\frac{1}{9}$ part of the ſurface of the greater, could not be ſatiated under 9 times as many Days as the greater.

White Vitriol, by Dr. Liſter, n. 256. p. 331.

LXXXVIII. All I can find of the *Origin* of *White Vitriol* is out of *Borrbichius de Docimaſtica Metallica*, that it is produced from a certain *Lead Ore* boil'd raw. (*Plumbi Nigri Vena*, Vitriolum Album *producit, etiam non Cremata*) None, that I know of, of our *Engliſh Lead Ores* gives us any ſuſpicion of any ſuch *Vitriol*. It is true, I have by me ſome ſorts of *White Lead Ore, Spar-like*, plentifully yielding *Lead*; But I cannot ſay, that either thoſe, or any colour'd *Lead Ores*, did give me any Reaſon to ſuſpect, after divers Experiments upon them, that they yielded white Vitriol.

As to the *Chryſtals* of *white Vitriol*, they are very difficult to deſcribe; and ſeems to me to be a Congeries of infinite ſmall Needles; for which Reaſon 'tis of a moſt ſpeedy Operation, and irritates the Stomach ſuddenly, before they can be well diſſolv'd or broken.

Alum Works, by Mr. *Dan. Colwall*, n. 142. p. 1052

LXXXIX. *Alum* is made of a Stone, of Sea-weed and Urine.

The *Stone* is found in moſt of the Hills between *Scarborough* and the River of *Tees* in the County of *York*. As alſo near *Preſton* in *Lancaſhire*. It is of a blewiſh Colour, and will cleave like *Corniſh Slate*.

The Mine which lies deep in the Earth, and is indifferently well moiſtned with Springs, is the beſt. The dry Mine is not good; and too much Moiſture cankers and corrupts the Stone, making it nitrous.

In this Mine are found ſeveral Veins of Stone called *Doggers*, of the ſame Colour, but not ſo good. Here are alſo found thoſe that are commonly called *Snake-ſtones*, the People have a Tradition, that the Country thereabouts being very much annoyed with Snakes, by the Prayers of St. *Hilda*, there inhabiting, they were all turned into Stones, and that no *Snake* hath ever ſince been ſeen in thoſe parts.

For the more convenient working of the *Mine*, which ſometimes lie 20 *Yards* under a ſurface or Cap of Earth, (which muſt be taken off and barrow'd away) they begin their Work on the declining of a Hill, where they may be alſo well furniſhed with Water. They dig down the Mine by Stages, to ſave Carriage, and ſo throw it down near the places where they calcine it.

The Mine before it is calcined being expoſed to the Air, will moulder in pieces, and yield a Liquor whereof *Copperas* may be made: but being calcined it is fit for *Alum*. As long as it continues in the Earth, or in Water, it remains a hard ſtone.

Somesimes a Liquor will iſſue out of the ſide of the Mine, which by the Heat of the Sun is turned into natural *Alum*.

The *Mine* is calcined with *Cinders* of *Newcaſtle Coal*, *Wood* and *Furzes*; the Fire made about 2 Feet and an half thick, 2 Yards broad, and 10 Yards long. Betwixt every Fire are ſtops made with wet Rubbiſh, ſo that any one or more of them may be kindled, without prejudice to the reſt.

After there are 8 or 10 *Yards thickneſs* of broken *Mine* laid on this Fewel, and 5 or 6 of them ſo covered: Then they begin to kindle the Fires, and as the Fires riſes towards the top, they ſtill lay on freſh *Mine*, ſo that to what Height you can raiſe the Heap, which is often times about 20 yards, the Fires without any further help of Fewel will burn to the top, ſtronger than at the firſt Kindling, ſo long as any Sulphur remains in the ſtones.

In calcining theſe Stones, the Wind many times does hurt, by forcing the Fire in ſome places too quickly through the Mine, leaving it black and half burnt, and in others burning the Mine too much, leaving it red. But where the Fire paſſeth ſoftly and of its own Accord, it leaves the Mine white, which yields the beſt and greateſt Quantity of Liquor.

The *Mine* thus calcin'd, is put into Pits of water, ſupported with frames of Wood, and rammed on all ſides with Clay, about 10 Yds. long, 5 Yds. broad, and 5 Feet deep, ſet with a Current that turneth the Liquor into a *Receptory*, from whence it is pumped into another *Pit* or *Mine*; ſo that every Pit of Liquor, before it comes to the boyling, is pumped into 4 ſeveral Pits of Mine; and every Pit of Mine is ſteeped in 4 ſeveral Liquors, before it be thrown away, the laſt Pit being always Freſh Mine.

This *Mine* thus ſteep'd in each of the ſeveral Liquors 24 Hours, or thereabout, is of Courſe 4 Days in paſſing the 4 ſeveral Pits, from whence the Liquors paſs to the boyling Houſe.

The *Water*, or *Virgin Liquor*, oft times gains, in the firſt Pit, 2 Pound Weight. In the 2*d*. it increaſeth to 5 pound weight; In the 3*d*. to 8 Pound Weight; and in the laſt Pit, which is always freſh *Mine*, to 12 Pound Wt. and ſo in this Proportion, according to the Goodneſs of the Mine, and the well calcining thereof. For ſometimes the Liquors paſſing the 4 ſeveral Pits, will not be above 6 or 7 Pound Weight; at other times above 12 Pound Weight, ſeldom holding a conſtant Weight one Week together. Yet many times Liquor of 7 or 8 Pound weight produceth more *Alum* than that of 10 or 12 Pound weight, either thro' the Illneſs of the *Mine*, or, as uſually, the bad calcining thereof. And if by paſſing the weak Liquor thro' another Pit of freſh *Mine*, you bring it to 10 or 12 Pound Weight: Yet you ſhall make leſs *Alum* with it, than when it was but 8 Pound Weight. For what it gains from the laſt Pit of *Mine*, will be moſt of it *Nitre* and *Slam*, which poyſons the good Liquors, and diſorders the whole Houſe, until the *Slam* be wrought out.

That which they call *Slam*, is firſt perceived by the Redneſs of the Liquor when it comes from the Pit, occaſioned either by the Illneſs of the *Mine*, or, as commonly, the over or under calcining it, as aboveſaid; which in the Settler ſinks to the bottom, and there becomes of a muddy Subſtance, and of a dark Colour. That Liquor which comes whiteſt from the *Pits* is the beſt.

When a Work is firſt begun, they make *Alum* of the Liquor only that comes from the Pits of Mine, without any other Ingredients. And ſo might continue, but that it would ſpend ſo much Liquor as not to quit Coſt.

Kelp is made of a *Sea-weed*, called *Tangle*, ſuch as comes to *London* on *Oyſters*. It grows on Rocks by the Sea-ſide, between High-water and Low-Water Mark. Being dried, it will burn, and run like *Pitch*; when cold and hard, 'tis beaten to *Aſhes*, ſteeped in Water, and the *Lees* drawn off to 2 pound Weight, or thereabouts.

Becauſe the Country People, who furniſh the Work with *Urine*, do ſometimes mingle it with Sea-water, which cannot be diſcovered by Weight, they try it, by putting ſome of it to the boyling Liquor; for ſo, if the *Urine* be good, it will work like *Yeaſt* put to *Beer* or *Ale*, but if mingled, it will ſtir no more than ſo much Water.

It is obſerved, that the beſt *Urine* is that which comes from poor labouring People, who drink little ſtrong Drink.

The *boyling Pans* are made of *Lead*, 9 Feet long, 3 Feet broad, and 2 and a half deep, ſet upon iron Plates about 2 Inches thick, which *Pans* are commonly new caſt, and the Plates repaired 5 Times in 2 Years.

When the Work is begun, and *Alum* once made, then they ſave the Liquor which comes from the *Alum*, or wherein the *Alum* ſhoots, which they call *Mothers*; with this they fill 2 third parts of the *Boylers*, and put in one third part of freſh Liquor which comes from the Pits. Being thus filled up with cold Liquor, the Fires having never been drawn out, will boil again in leſs than 2 Hours Time; and in every 2 hours time the Liquor will waſte 4 Inches, and the Boylers are filled up again with green Liquor.

The Liquor, if good, will in boyling be greaſy, as it were, at the Top: if nitrous, it will be thick, muddy, and red. In boiling 24 Hours, it will be 36 Pound Weight. Then is put into the *Boiler* about a Hogſhead of the *Lees* of *Kelp*, of about 2 Penny Weight, which will reduce the whole *Boyler*, to about 27 Pound Weight.

If the Liquor is good, as ſoon as the *Lees* of *Kelp* are put into the Boiler, they will work like *Yeaſt* put to *Beer*; but if the Liquor in the Boiler be nitrous, the *Kelp Lees* will ſtir it but very little; and in that caſe, the Workmen muſt put in the more and ſtronger *Lees*.

Preſently after the *Kelp Lees* are put into the *Boiler*, all the *Liquor* together, is drawn into a *Setler*, as big as the *Boiler*, made of *Lead*, in which it ſtands about 2 hours, in which time moſt of the *Nitre* and *Slam* ſink to the bottom.

This Separation is made by means of the *Kelp Lees*, for when the whole *Boiler* conſiſts of green Liquor drawn from the Pits, it is of a Power ſtrong enough to caſt off the *Slam* and *Nitre*, but when the *Mothers* are uſed, the *Kelp Lees* are needful to make the ſaid Separation.

Then the ſaid Liquor is ſcooped out of the *ſetler*, into a *Cooler* made of *Deal-boards*, and rammed with *Clay*. Into this is put 20 *Gallons*, or more of *Vrine*, more or leſs according to the *Goodneſs* or *Badneſs* of the *Liquor*; for if the Liquor be red, and conſequently *nitrous*, the more *Vrine* is required.

In the *Cooler*, the Liquor in temperate Weather ſtands 4 Days. The 2d. Day the *Alum* begins to ſtrike, gather and harden about the ſides, and at the Bottom of the *Cooler*.

If the Liquor ſhould ſtand in the *Cooler* above 3 Days, it would, as they ſay, turn to *Copperas*.

The Uſe of *Vrine*, is as well to caſt off the *Slam*, as to keep the *Kelp Lees* from hardning the *Alum* too much.

In hot weather the Liquors will be one Day longer in cooling and the *Alum* in gathering, than when the Weather is temperate. In froſty Weather, the Cold ſtrikes the *Alum* too ſoon, not giving time for the *Nitre* and *Slam* for to ſink to the bottom, whereby they are mingled with the *Alum*. This produceth double the quantity, but being foul, is conſumed in the waſhing.

When the Liquor hath ſtood 4 Days in the *Cooler*, then that called *Mothers* is ſcooped into a Ciſtern, the *Alum* remaining on the ſides, and at the Bottom; and from thence the *Mothers* are pumped back into the *Boiler* again. So that every 5 Days the Liquor is boiled again, until it evaporate or turn into *Alum* or *ſlam*.

The *Alum* taken from the ſides and bottom of the Cooler, is put into a Ciſtern and Waſhed with Water that hath been uſed for the ſame purpoſe; being about Twelve Pound Weight. After which it is Roached as followeth.

Being Waſhed it is put into another Pan with a quantity of Water, where it Melts and Boils a little. Then it is ſcooped into a great Cask, where it commonly ſtands 10 Days, and is then fit to take down for the Market.

The Liquors are Weighed by the *Troy* Weight; ſo that half a Pint of Liquor muſt Weigh more than ſo much Water, by ſo many Penny Weight.

Experiments about Vitriol, Sulphur *and* Alum; *By* ... n. 103. p. 4

XC. *Vitriol* is of ſeveral kinds, being for Colour, *White*, *Yellow*, *Green*, or *Blue*; uſually of the two laſt mentioned: And is made either of *Mineral Waters*, boiled up to a convenient Conſiſtence; then ſet to *Cryſtallize*: Or extracted by Common Water out of Earths impregnated therewith. 'Tis alſo afforded by many ſorts of Stones, commonly called *Pyrites* and *Marcaſites*, which expoſed ſome Months to *Aerial* Influences, are reſolved into Powder, and the *Saline* Part diſſolved in Rain or other Water; then boil'd and ſet to ſhoot, yield ſtore of *Vitriol*, eſpecially with the Addition of *Copper* or *Iron*. It is often Aſſociated with Earth and Stones, wherein Metals are contained; and with many Natural Recrements of Metals, ſuch as *Miſy*, *Sory*, *Chalcitis*; from which 'tis uſually ſeparable by the common method, with Water; ſome times not to be Extricated until the *Mineral* be firſt Calcined or Burnt. It is alſo frequently found Pure and Perfect in the Caverns of the Earth, being an *Efloreſcence* of ſeveral *Minerals*; and this is accounted by all *Naturaliſts*, the beſt, both for *Medicinal* and *Spagyrical* uſes. Laſtly, it is Copiouſly contained in common *Mineral Sulphur*.

Vitriol conſiſts of *Inſipid Phlegm*, *Earth* or *Oker*, ſome *Metal*, *Mineral Sulphur*, an *Acid Salt* or *Spirit*, together with ſome ſmall Portion of the *Volatile Aerial Salt*. That it contains Water, needs no great Proof, ſince no *Saline* Subſtance can *Cryſtallize* without it; and Diſtillation will Convince any Perſon, that it exceeds in Quantity any of the other Principles.

The *Earth* or *Oker* may be thus ſeparated. Diſſolve *Vitriol* in fair Water, immediately a Yellow Powder will ſeparate, and in a ſhort time Subſide. The greater the Quantity of Water imployed, the more *Oker* Precipitates: The weaker the *Lixivium*, the leſs able to ſupport Bodies more Ponderous than common Water; and the lighter the Water (as if diſtilled Rain-Water, or *Phlegm* of *Vinous Spirits*,) the more *Earthly* Parts Subſide, upon the ſame *Hydroſtatical* Principle. I have above 20 times repeated this Diſſolution, ſeconded by *Filtration* and *Coagulation*, and each time ſeparated ſome Quantity of this Earth: And I am perſwaded, had I long continued the Operation, the Succeſs would have been the ſame, only I obſerved the Quantity ſeparated each time ſenſibly to diminiſh. But I have found a more eaſie and expedite way of effecting this Separation. Take a good quantity of the common *Dantzick* or *Hungarian Vitriol*; having powder'd it, put it into a ſlender *Cucurbite*; Place it in Water, keep under it an equal conſtant Fire 3 or 4 Days: The *Vitriol* will, without Addittament, become

Fluid, as if diſſolved in *Water*, and the *Oker* with moſt of the *Metalline* parts, with the Groſs *Sulphur*, will ſubſide, and become a hard Cake at the bottom, the *Vitriol* being fluid about it, which in the Cold again *Cryſtallizeth*; excepting a ſmall quantity of *Liquamen* of the ſame nature with that we ſhall hereafter Mention. This Repeated once or twice, the *Vitriol* attains unto a high degree of Purity, and is eaſily capable of many Alterations, whereunto it was not ſubject before this Purification. This Operation will not ſucceed in a dry Digeſtion; I mean, *Aſhes*, *Sand*, *Filings* of *Iron* or *Steel*, *Open Fire*, or even *Flame* of *Lamps*, whether fed with *Oyl* or *Spirit* of *Wine*. This *Earth* may be alſo obtained in a great Proportion, though in another Form, if after a long and Intenſe *Calcination*, the *Vitriol* is freed from its remaining Salt, by frequent *Ablutions* with warm *Water*: The far greateſt part of this *Dulciſy'd Colcothar* is *Inſipid Earth* with ſome ſmall proportion of *Metal*. The ſame may be *Precipitated* by *Salt of Tartar*, or any other *Alcalies*, or *Filings* of *Zink*, or other Immature *Minerals*, out of a Solution of *Vitriol* in common *Water*. It being alſo ſeparated from *Metalline* and *Saline* parts, by a Method I ſhall hereafter mention, there remains a great quantity of an *Inſipid* Subſtance nearly reſembling *Burnt Alum*. Beſides, whereas *Salt*, *Nitre*, *&c.* require in *Diſtillation* a large quantity of *Earthly* Subſtance, to disjoin the *Saline* Parts, and prevent *Fuſion*: *Vitriol* and *Alum* need it not; an unqueſtionable Proof, that *Earthy* Parts abound therein.

That *Vitriol* contains Sulphur, is evinced by the Sulphureous ſmell it emits in *Diſtillation*, eſpecially if urged with a ſtrong Fire from the beginning; and the Spirit thus drawn being Rectifyed, the Liquor, which firſt ariſes, hath a highly Sulphureous Smell; as hath alſo that we ſhall hereafter mention, Diſtilled from *Vitriol* deprived of its *Metallick* parts. The *Colcothar Dulciſy'd*, or *Metallick* parts Precipitated by an *Alcali*, or *Immature Mineral Sublimed* with *Sal Armoniack*, an *Inflammable* Sulphur may be many ways ſeparated, both from the *Sublimate* and *Caput Mortuum*. The common Oyl of *Vitriol* digeſted on *Antimony*, then Diſtilled, yields a much greater quantity of Sulphur, than would have been produced, had any other *Acid* Liquor been imployed; and the ſame Oyl of *Vitriol* digeſted with *Spirit* of *Wine*, and Diſtilled, yields an Oyl, and at the latter end, ſtore of Sulphureous Inflammable Flowers.

As for the *Acid Saline* Principle, I ſuppoſe no Perſon who hath Taſted of the Spirit of *Vitriol*, and, that abuſively called, its Oyl, will Queſtion its abounding in that ſubject.

In order to the Reſolution of ſome Enquiries about the *Saline* Principle, I made theſe Experiments. I took 4 or 5 Gallons of the *Vitriolate Water*, which was conveyed by Artificial Channels at *Deptford*, from the Beds of *Pyrites* or *Marcaſites* into the great Ciſtern, I Diſtilled therefrom, in Glaſs Veſſels, two Thirds of *Inſipid Water*, letting the Glaſſes Cool, the *Water* let fall a *Vitriol* of a lovely Dilute Colour, together with a great Quantity of that Yellow Sediment which we formerly call'd *Oker*. Then Evaporating a Third part of the remaining Liquor, I received more *Vitriol* of a Paler Colour than the former, and *Oker* as before, though leſs. The 5th time this

Operation was repeated, inſtead of *Vitriol* it afforded a Yellow, and ever after a *White Salt*, which did differ exceedingly from *Vitriol*, not only in Colour, but alſo Taſte; being Fiery and Pungent; and did partake little of that Abominable Rough Aſtringent Smack which is Peculiar to *Vitriol*. It was alſo *Unctuous*, like *Salt* of *Tartar*, made the Hands ſoft and ſupple, cleanſing like a *Sapo*, whereas common *Vitriol* renders them Rough and Harſh: Being diſſolved in *Water*, it appeared to the very Eye very *Fatty* and *Oleaginous*.

From 5 Pounds and an half of *Lixivium*, I received 4 Pounds of this Fiery *White Salt*, beſides half a pound of *Liquamen*, which remained Fluid, and would not *Coagulate*. I do the rather mention this, for that it is one of the moſt eminent Inſtances, I ever met withal, of ſo great a quantity of Salt kept fluid in the Cold, by ſo ſmall a quantity of *Water*.

The remaining *Liquamen* was very fiery, Acidly Pungent, and extreamly Ponderous; no whit Inferiour, in my Opinion, in any of theſe reſpects to common Oyl of *Vitriol*, it ſeeming to me ſtrange and unuſual, that ſo ſtrong a Liquor ſhould be obtained without any conſiderable degree of Fire.

This *Liquamen* being expoſed unto the Air, ſoon Attracted double its quantity of Moiſture: I cannot recollect, that I did ever obſerve any Fluid Body, which approached near unto it for this Property: Though I am not ignorant, that all *Corroſive ſaline* Liquors will borrow conſiderably from their neighbouring Element. I always obſerved this *Liquamen* to acquire more or leſs Moiſture, according to the Conſtitution of the Seaſon, riſing ſenſibly in moiſt Weather, and little in Dry.

The White Salt, laſt mentioned, was Diſtilled in a Sand Furnace, and the far greater part came over in the Form of a Spirit highly *Acid*, eſpecially that which came laſt in ſmall Drops. This Liquor Rectified in a very tall Body, immediately upon the Approach of the ſmalleſt degree of Heat, a *Volatile Sulphureous* Spirit did ariſe, clear as Rock Water, almoſt, nay I think altogether *Inſipid*; yet the ſmell ſo Subtile and Penetrating, that 'twas Inſupportable: And ſuch it continued many Years, not letting fall any Sediment, and thereby loſing its ſtrength, as doth the *Volatile Spirit* made out of common *Vitriol*. The Spirit which remained after the Separation of the more *Volatile*, was in all reſpects like that of *London Vitriol*; only ſeemed more gratefully *Acid*, and might, like it, be ſeparated into Spirit and Oyl, corruptly ſo ſtiled.

Vitriol freed, as is before declared, from its *Earthy* and *Metallick* parts, by *Zink*, or other *Imperfect Minerals*, is much of the ſame nature, and yields its Spirit in Sand, as this we have now mentioned; is alſo White, and more *Unctuous*; hath a grain more like *Nitre* than *Vitriol*, as hath alſo the *Goſlar Vitriol*, which is White, and comparatively *Unctuous*, becauſe it hath little Metal, and leſs *Mineral Sulphur* than the Common; whoſe *Metalline* part detains the *ſaline*, and will not diſmiſs it until long urged by a very intenſe degree of Heat. What remained in the *Retort*, after this *Diſtillation* was not Red or Purple, like the *Caput Mortuum* of the common *Vitriol*, but *White*, *Light*, and *Spongious*, like *Burnt Alum*, and altogether as *Inſipid*; although, after it was ſome time expoſed unto the *Air*, it received many ſtrange Impreſſions and Alterations.

I cannot but take notice here of the great Affinity that is between *Vitriol*, *Alum*, and *Mineral Sulphur*; the *ſaline* Principle, which is in each of them n. 104. p. 66. by far the Chief, both in Quantity and Energy, having one Nature and the ſame Properties. This will appear Evident to thoſe who will compare with the common Spirit, or Oyl of *Vitriol*, the *Acidity* of *Sulphur* afforded by Brimſtone Inflam'd under a Glaſs Bell; which being Rectify'd, is not to be Diſtinguiſh'd, by any ſenſible Property, from the well *Rectifyed Acidity* or Oyl of good *Vitriol*; and they may, I am confident, be ſafely ſubſtituted for each other, producing in Men and Metals the very ſame Effects, being in my Apprehenſion, no leſs alike in their Internal and ſecret, than in their *External* ſenſible Qualities.

The quantity indeed of *Acidity*, which is obtained in the ordinary ways of Operation, is very ſmall, a Pound of Brimſtone not yielding above one Ounce or 10 Drachms, the far greater part being by the rapid motion of the Flame Sublimed in the form of *Flores*, which differ not from the common *Flowers*. I have been often aſſured by a Kinſman of that admirable Mechaniſt *Cornelius Drebbel*, that his Uncle did, by the means of conveniently ſhaped Veſſels, ordinarily obtain out of a Pound of good Brimſtone, 8, and in a very moiſt Seaſon, 10 Ounces of *Acidity*; and was confident, he could, by improving the Contrivance, recover the entire weight of the *Sulphur*; the moiſture of the Air acquired, making abundant recompence for the Avolation of what is *Incoagulable*. I have my ſelf, by the means of ſeveral *Menſtrua*, reduced common Brimſtone into the form of an highly *Acid Corroſive* Liquor, and even Spirit of *Nitre*, or *Aqua-fortis* well Rectified, being digeſted on the *Flowers* of *Brimſtone*, then Diſtilled in Aſhes, this Repeated 5 or 6 times, after the laſt *Cohobation* there will remain with the Flowers near their Weight of an *Acid Spirit*, like that made by a Bell; the Spirit of *Nitre* being ſcarcely changed from what it was before the Operation. And I ſuppoſe, that being Reiterated frequently, eſpecially if freſh Spirit be employed, the whole may be Tranſmuted, abating ſome few Earthy and Metallick Particles, the Sulphureous being capable of a Fluid form, and are copious in Oyl in *Vitriol*, *Aqua fortis*, and many other *Acid Menſtrua*, eſpecially if any Imperfect Sulphureous Minerals were imployed with the other Ingredients in their Production.

I once made out of *Vitriol*, common Salt, and *Antimony*, a Liquor Clear as any Fountain Water, yet the Smell intolerably Sulphureous, continuing ſo many Years: And true Inflammable Sulphur may ſeveral ways be recovered out of Oyl of Vitriol, or Sulphur, many times Rectified, and in appearance free from ſuch Mixture. We formerly mentioned its Separation by means of *Vinous Spirits*. Alſo, if mixt with Oyl of *Turpentine*, and Diſtilled, at the latter end ſtore of Brimſtone will Sublime: I ſuppoſe, none will aſcribe this to the Vegetable Oyl, which is only the means of its Separation, being an appropriate *Menſtruum* or Diſſolvent of Sulphureous Bodies. This recalls into my Mind what I have often obſerved, (and I ſuppoſe it always happens) in the Preparations of Balſam of *Sulphur* with the ſaid Oyl of *Tur-*

pentine: After the Oyl is ſatiated with *Sulphur*, it lets fall ſtore of fair *Cryſtals*; An evident Proof of its *ſaline* Nature: For, although theſe Cryſtals broken, within appear full of *Sulphur*, their outward Parts or Superficies ſeem perfect Salt, by Vertue whereof they are diſpoſed to *Cryſtallization*. It may indeed be objected, that *Cryſtallization* is not a ſufficient Proof of a *ſaline* Nature, the *Eſſential Oyls* (as they are called) of *Anniſeeds*, *Fennel-ſeeds*, and of many other Subſtances being very Prone to *Cryſtallize*. But moſt *Eſſential Oyls* abound no leſs with Salt than common Sulphur, into which I have often converted them without Additament or Suſpicion of *Tranſmutation*.

The *Affinity*, I had almoſt ſaid *Identity* of the *ſaline* Principle in Sulphur and Vitriol, further appears by the following Experiment. Take thin Plates of Copper, Cement them carefully with common *Brimſtone*, *Stratum ſuper Stratum*, repeat the Operation 4 or 5 times with freſh Sulphur; moſt of the Copper will be converted into *Vitriol*, which diſſolved in Water, and moſt of that Evaporated, yields very Beautiful *Azure Cryſtals*. The ſame may be effected with Iron. Or, take the *Acidity* of *Sulphur* (corruptly called its Oyl) Moiſten therewith Filings of *Copper* or *Iron*; then free them by Fire or Air from Superfluous moiſture, repeat this twice or thrice; and afterwards with common Water you may Extract a fair *Vitriol*, which by the Chymiſts is called *Vitriolum Martis* or *Veneris*, according as the one or other Metal was imployed in order to its Production; which ſame Metals being diſſolved in any *Acid Menſtrua*, and Cryſtallized, are converted into Vitriol. This is ſignified unto us by the common Name of Vitriol, vulgarly ſtiled *Cuperoſum*, *quaſi Cuprum Eroſum*; that being the Metal wherewith 'tis uſually Aſſociated, *Sulphur* indeed is found mixt with moſt Metals and Minerals, Gold and Silver not being excepted, the moſt expert Mineraliſts in *Peru* accounting abundance of *Sulphur* an eſpecial ſign of Rich *Ore*: And among the Richeſt *Ore* of the Mountain of *Potoſi* are ſuch quantities of Brimſtone, that the Cavities and hollow Places are preſently filled with Flame if a Candle touch or come near their ſides. Yet they do not ordinarily find *Vitriol* in Mines of Gold and Silver (unleſs mixed with other Metals) becauſe thoſe Bodies are ſomething too compact for the Sulphureous Spirit to diſſolve aſſiſted with a ſmall degree of Heat; whereas all *Ores*, which touch on *Copper* or *Pyrites* abounding in *Sulphur* do alſo afford *Vitriol*, Copper being an open Body, and more eaſie ſoluble than any other Metal, for it will preſently, though Crude, diſſolve in, and give a deep Tincture to common *Volatile Urinous Spirits*: Which cannot be affirmed of any other Metal, howſoever prepared; and therefore no wonder if it be not by the Steam of *Sulphur* ſo eaſily converted into *Vitriol*. And in the Bowels of the Earth it is, I do conjecture, moſtly produced after this manner; an *Acid Saline-Sulphureous* ſteam, (ſuch we have proved that of common *Sulphur* to be) inſinuating it ſelf into a Vein of *Copper*, Corrodes it, and uniting therewith becomes *Vitriol*. So it doth by mixture with Iron and other Minerals; whence being waſhed with Water, it produces *Acidulæ* of divers kinds, according to the Nature of the Minerals, wherewith the *Acid* is united. And that *Vitriol* and *Vitriolate Waters* are thus produced, is hereby

Alonſo Barba's *Art of Metals. Lib.* I.

confirmed, that many *Ores* and *Pyrites* being Diſtilled *per Deſcenſum*, yield abundance of Common *Sulphur*: The Remainder thereafter affords ſtore of *Vitriol*, although before Calcination it would have yielded none; the Fire enabling the *Sulphur* to Corrode, and Aſſociate with the *Metallick* parts, that which is without Mixture of *Metal*, or which hath thereof a very ſmall Proportion, continuing under the form of Brimſtone.

This to me ſeems the Reaſon, why *Vitriol* and Brimſtone are uſually found together: Thoſe Minerals and Pyrites that abound with one, being uſually impregnated with the other; *Vitriol* not being a diſtinct Principle, but the Genuine off-ſpring of *Sulphur* its Material Cauſe, and Fire and Air the Efficient cauſes of its Production.

I ſpeak of *Vitriol* Generated in the Bowels of the Earth; for it may be, and is often, produced above Ground, by the *Aerial Salt* united with Mineral ſubſtances copiouſly contained in *Marcaſites*, which it Extricates, and Coagulating therewith becomes a Vitriol. This *Aerial* Salt, which I have many ways procured, whilſt in the Air, is altogether Unſpecificate, I mean freed from all union with, or Determination by, any Seminal Principles, (the *Primordials* of all *Species* in the Univerſe being in my Opinion *Spermatical*) but being once at the Command of the *Architectonick* Power of any Species, whatſoever that be, it is by it, with other Matter, determined in order to the Formation and Augmentation of the *Individuum*, and Propagation of the Species, and upon the Diſſolution of its Dwelling, returns whence it deſcended. Beſides this there is alſo in the Air an *Acidity*, as is Evident in *Iron* Bars, whoſe Superficies is thereby reſolved into a Subtile *Crocus*; alſo in the Tarniſhing of *Poliſh'd* Metals, where Pit-Coal is much Burnt, near unto and on the Sea, and where Expoſed to certain Winds.

This *Acid Spirit* with the Salt laſt mentioned, are Inſtrumeuts by Nature imployed in almoſt every Operation; eſpecially the Salt, without which no Perfect Animal can ſubſiſt a Minute, and all Vegetables deprived thereof, do immediately Decay. It's well known that ſeveral Minerals and Pyrites, which are to the Taſte altogether inſipid and elixiviated, and would yield not a Grain of Salt. being expoſed unto the Air are reſolved into a Powder, and afford ſome *Alum*, others Vitriol Copiouſly. Sometimes the Minerals require Previous Calcination, which opens and Relaxes the Compages of the Bodies: So that the Air may have more eaſie ingreſs. And it is, I think, by moſt allowed, that after all the Salt is extracted out of Earth impregnated with *Vitriol*, *Alum* or *Nitre*, the ſaid Earth being expoſed a ſufficient time unto the Air, acquires freſh Supplies: Which muſt be derived from the Air. And it is particularly remarkable in Vitriol and Allum that their Spirit being put into a Commotion or Fermentation by either Heat or contrary natur'd Spirits, the Glaſſes which contain them being well cloſed although large and ſtrong, will be crack'd or broken in pieces; which ſeems to proceed from the Expanſion of ſome of thoſe prodigiouſly Active Springy particles, wherewith the Air abounds, which together with the *Aerial Salt* were Arreſted by the Vitriolifying Principle, and ſet at Liberty by the Tumultuating Liquor, the change of whoſe Contexture might occaſion their Diſmiſſion, the unbending of their Springs, and the Effects which thereupon enſue.

The Affinity between Vitriol and Natural, not Factitious, Alum, thus appears. Vitriol not only in *England*, but in ſeveral other Parts of the *World*, is ordinarily found in the ſame Vein, and ſometimes in the ſame Parcel, which yields the Alum: Which may by ſeveral Methods be ſeparated from each other. The Mineral of Alum, if Mature, *Elixiviated* yields its Salt preſently; if leſs Mature, it requires Previous Calcination; if very immature, it muſt not only be Burnt, but long expoſed unto the Air.

The Cauſe whereof ſeems the very ſame, with that we lately mentioned in our account of the Production of Vitriol; the Alum,' as that is, being Produced by the *Sulphurs* acting on, Corroding of, and Coagulating with, ſome Mineral Subſtance, which uſually partakes more of *Terrene* and *Stony*, than *Metallick*, Nature: Although yet Metal is often found to be contained in the Alum-Stone or *Ore*. And that the *Sulphur* is the chief Efficient and Material Cauſe of its Production, appears from hence, that many Alum-Stones (as the Vitriolate) Diſtill'd *per Deſcenſum*, yield good Brimſtone; and all Allum-ſtone or *Ore*, during Calcination Emit a *Sulphureous* ſteam. An inquiſitive Naturaliſt of my Acquaintance did gather from the very ſame Rock, and that within a few Inches of each other, Vitriol, Alum, and *Sulphur*, all of them Excellent and Perfect in their Kind. Indeed they are ſo nearly Allied, that I can by ſome pretty Artifices (too long to be here deſcribed) convert *Alum* into *Vitriol*, or *Vitriol* into *Alum*, which ſhall be the *ſame*, to all intents and purpoſes, (as we commonly ſpeak) with the *Natural*.

Alum Diſtilled into an *Acid Spirit* with Copper or Iron, becomes good Vitriol; and Vitriol freed from its Metallick parts becomes *Aluminous*; and diſtill'd, yields a Spirit ſcarcely to be diſtinguiſh'd not only by Taſte, but even by the Nice and Accurate ſcrutiny, from that of Alum. And (which doth in ſome meaſure Illuſtrate this *Affinity*) I have often obſerved rectified Oyl of Vitriol and Spirit of Sulphur to Coagulate, and become Solid Tranſparent Concretions, exactly reſembling Alum Cryſtallized, with which Compared, I am confident, the moſt Judicious Eye, without the Aſſiſtance of the Palate, would find little difference.

The *Salt* in *Brimſtone* is thus derived. *Brimſtone* conſiſts of *Mineral Sulphur* and an *Acid Salt*, which being united it is no Difficult matter to conceive how it ſhould become *Volatile*, if we reflect on *Cinnabar* and *Sublimate* in one, *Mercury* is ſo diſguiſed by a little *Sulphur*, that it ſeems a *Mineral* ſubſtance of another Nature, and abating the Colour, not unlike *Antimony*: In the other, Salts very Acid and Fixt are rendered ſufficiently Volatile. Now whence the Brimſtone ſhould Derive its Sulphureous Particles, will appear very Obvious to them, who have obſerved how much the Bowels of the *Earth* abound with *Bituminous* ſubſtances. What elſe feed all the *Subterraneous Fires*? What an Immenſe Quantity thereof is lodged in the *Earth*, will be atteſted by our large and Numerous *Coal-Mines*, and by thoſe Eruptions of *Bituminous* ſubſtances in many Quarters of the World; among which that call'd *Naphtha*, is ſo purely ſulphureous, ſo free from Mixture with any other Materials, that upon the very Approach of Fire or Flame it is immediately inflamed, and ſcarcely to be extinguiſh'd until wholly conſumed. As for the ſaline Principle of *Sulphur*, I conclude it to be common *Salt*, which, together with the *Aerial Salt* before mentioned, is the Foundation of all *ſaline* Subſtances in the Univerſe. And I aſſure you, I can with common Salt make both *Vitriol* and *Alum*, hardly diſtinguiſhable from the natural.

The Eﬄoreſcence of certain Mineral Glebes by Dr. *Liſter*; n. 110. p. 221.

XCI. I kept by me certain big Pieces of *Crude-Alum Mines*, ſuch as it was taken out of the Rock, I had alſo in the ſame Cabinet like pieces of the ordinary *Fire-ſtone*, or *Marcaſite* of the Coal-pits, which here we call *Braſs Lumps*.

In Proceſs of Time, both the Glebes ſhot forth *Tufts* of long and ſlender Fibres or Threads; ſome of them half an Inch long, bended and curled like Hairs. In both theſe Glebes, theſe Tufts were in ſome Meaſure tranſparent and cryſtalline. Theſe *Tufts* did as often repullulate, as they were ſtruck and wiped clean off.

The *Aluminous Fibres* were of a *Taſte* very *Alumy*, and pleaſantly pungent: The *Vitriolick*, *Stiptique* and odious. Again, the *Alum* ones, being diſſolved in Fair Water, raiſed a ſmall *Ebullition*: Whereas the *Vitriolick Fibres* diſſolved quietly. The *Alum Fibres* were generally ſmaller, and more opaque, Snow-like. The *Vitriolick* larger, many Fibres equalling an Horſe-Hair in Thickneſs, and more *cryſtalline*. The Water wherein the *Alum Fibres* were diſſolv'd, did give no red Tincture with Gall, not by all the means I could deviſe to aſſiſt them: the *Vitriolick* did immediately give a *Purple Tincture* with *Gall*.

Having laid pieces of the ſame *Marcaſite* in a Cellar, they were in a few Months covered over with green *Copperas*, which was theſe Fibres ſhot and again diſſolved, by the moiſt Air, cloddered and run together, expoſing other pieces of the ſame vitriolick Glebe in my Window, where the Sun came, they were covered over with a white Farinaceous Matter; that is, with theſe Fibres calcined by the Rays of the Sun and warm Air, beating upon them.

I take theſe Fibrous and thread-like Shootings of *Alum* and *Vitriol* to be moſt genuine and natural, and their Angular Shootings, after Solution into *Cubes* and *Rhomboides*, to be forc'd and accidental; *Salts* of very different Natures, as well vegetable as foſſile, by a like Proceſs in cryſtallizing of them, being obſerved to ſhoot into like Figures.

Amianthus, By . . n. 72. p. 2167.

XCII. 1. *Signior Marco Antonio Caſtagna*, Superintendent of ſome Mines in *Italy*, hath lighted, in one of them, upon a great Quantity of that lanuginous Stone call'd *Amianthus*, which he knows ſo to prepare, as to render it like either to a very white *Skin*, or to a very white Paper; both which reſiſts the moſt violent Fire. The Skin was covered with kindled Coals, whence it took Flame, but being taken out, after it had been left there a while, the fiery Colour preſently diſappear'd, and it became cold and white again as before; the Fire it ſeems paſſing only thorough, without waſting or altering any thing of it; whereas ſome of the hardeſt and ſolideſt Metals, as *Iron* and *Copper*, reduced to very thin Plates, and kept as long in the Fire as this ſubſtance was, would caſt Scales. Again, this Skin being made as thin as Paper, doth not only yield that ancient and ſo much admired *Amianthus*; but is alſo perfecter than that which comes from *Cyprus*; and not inferior to that which ſometimes, though but ſeldom, comes out of *China*. This Paper was alſo try'd in the Fire; and there it remain'd likewiſe without any viſible Detriment, or without the leaſt Change of its firſt Whiteneſs, Fineneſs or Softneſs. Of the ſame Matter this Artiſt hath wrought a Wick, never to be conſumed as long as 'tis fed, nor altering its Quality after the Aliment is waſted away.

By Mr. Edw. Lloyd, n. 166. p. 823.

2. The *Lapis Amianthus*, or *Linum Foſſile Asbeſtinum*, is found in no ſmall Quantity in *Llan Fair yng Hornwy* in the Northern part of *Angleſey*, where it runs in Veins thro' a Rock of Stone, in Hardneſs and Colour not unlike Flint. Theſe Veins are generally about ¼ of an Inch deep, which is the length of the *Amianthus*, and is ſeldom longer, but often ſhorter. It is compoſed of a lanuginous matter, exactly reſembling that of pappous Plants: But ſo cloſely compact, that till you draw a Pin, or any ſuch ſharp thing, croſs the Grain of it, it appears only a ſhining Stone, there being not the leaſt Filament of *Lint* to be perceived in it. In its natural Form, ſome of it looks whitiſh, and ſome ſtraw coloured, but all ſhining; but if pounded in a Mortar, the Brightneſs diſappears, and the whole becomes whitiſh. Note, that above and beneath the Veins there's a very thin *Septum* of terrene Matter, betwixt the *Amianthus* and the Stone whereto it adheres. I put a ſmall Quantity of the Lint in the Fire, which grew red hot; but tho' it remained there ¼ of an Hour, I could not perceive that it was any thing conſumed. I twiſted alſo ſome of it in the Form of a Wick, and dipping it in Oyl, it gave as good a Flame as other Wicks, till the Oyl was conſumed, the *Wick* remaining of the ſame proportion as at firſt. Being ſatisfied it was incombuſtible, I pounded ſome quantity of it in a ſtone Mortar, till it became a downy ſubſtance: Then I ſifted it thro' a fine Searce, by which means the terrene parts (being reduced to a Powder) came thro' the Searce, the *Linum* remaining I then brought it to a *Paper-mill*, and putting it in Water in a Veſſel juſt capacious enough to make Paper with ſuch a Quantity, I ſtirred it pretty much, and deſired the Workmen to proceed with it in their uſual method of making *Paper*, with their *Writing Paper Mould*, only to ſtir it about ever before they put their *Mould* in, conſidering it as a far more ponderous ſubſtance than what they uſed, and that conſequently if not immediately taken up after it was agitated, it would ſubſide. Paper thus made of it, proved but very courſe, and too apt to tear: But this being the firſt Trial, I have ſome Reaſon to believe it may be much improved.

Incombuſtible Cloth, By Mr. Nich. Waite, n. 178 p. 1049.

XCIII. I here ſend you the account of the *incombuſtible Linen Cloth*, which I received from one *Conco*, a Natural *Chineſe*, Reſident in the City of *Batavia* in the North-eaſt parts of *India*, who by means of *Keay arear Sukradana* (likewiſe a *Chineſe*, and formerly chief Cuſtomer to the old *Sultan* of *Bantam*) did after ſeveral Years diligence, procure from a great *Mandarin* in *Lanquin*, (a Province of *China*) near ¾ of a *Yard* of the ſaid Cloth; and declared, that he was credibly inform'd, that the Princes of *Tartary*, and others adjoining to them, did uſe it in burning their *Dead*; and that it was ſaid and believed by them, to be made of the under part of the Root of a Tree growing in the Province of *Sutan*, and was ſuppoſed, in like manner, to be made of the *Todda Trees* in *India*; and that, of the upper part of the ſaid Root, near the ſurface of the Ground, was made a finer ſort, which in 3 or 4 times burning, I have ſeen diminiſh almoſt half. They report alſo, that out of the ſaid *Tree* there diſtils a Liquor, which not conſuming, is uſed with a *Wick* made of the ſame Material with the Cloth, to burn in their *Temples* to Poſterity.

By [illegible] ib. p. 1050.

2. A Handkerchief, or Pattern of this *Incombuſtible Linen*, which was ſhewn the *Royal Society*, was a Foot long, and juſt half a Foot broad.

There were 2 Proofs of its reſiſting Fire, given at *London*, one before ſome of the Members of the *Royal Society* privately, *Aug.* 20. 1684. when *Oyl* was permitted to be poured on it whilſt red hot, to enforce the Violence of the Fire. Before it was put into the Fire this firſt Trial, it weighed one Ounce, ſix Drams, ſixteen Grains, and loſt in the burning 2 Drams, 5 Grains.

The ſecond Experiment of it was publick before the *Society*, *November* 12 following, when it weighed (as appears by the Journal of the *Society*) before it was put into the Fire, 1 Ounce, 3 Drams, 18 Grains. Being put into a clear Char-coal Fire, it was permitted to continue red hot in it for ſeveral Minutes: When taken out, though red hot it did not conſume a piece of white Paper on which it was laid. It was preſently cool, and upon weighing it again, was found to have loſt 1 Dram, 6 Grains.

Decem. 3. Mr. *Arthur Baily*, one of the Fellows of the *R.S.* preſented them with a Piece of this Linen in the Name of Mr. *Waite*. At the ſame time, the ſame Mr. *Baily* preſented Dr. *Plot* with another piece of it, which being brought to *Oxford*, the Experiment was again repeated on it, *Decem.* 16, it being put into a ſtrong Char-coal Fire, in the *Natural Hiſtory School*, in a full Meeting of the *Philoſophical Society* of that *Univerſity*, where after it had continued red hot for ſome conſiderable Time, it was taken forth again little altered when cold, ſaving that it ſeemed a little whiter and cleaner than before.

By Dr. Rob. Plot, ib. p. 1051.

3. This kind of *Linen-Cloth* was eſteemed by the Ancients, though then more common, and perhaps better known, than 'tis yet amongſt us, equally precious with the beſt of *Pearls*.

Nor is it now of mean Value even in the Country where made, a *China Covet*, (*i. e.* a Piece 23 Inches and ¼ long) being worth 80 *Tale*, *i. e.* 36 *l.* 13 *s.* 4 *d.*

The *Reality* of ſuch a Being has been doubted, or deny'd by very good Authors: Who though they owned ſuch a *Mineral* as *Amianthus*, out of the woolly part whereof, this ſort of Linen was always anciently ſaid to be made, yet queſtioned the Poſſibility of its having been actually done. But *Pliny* ſays expreſly (and I dare believe him in any thing he ſpeaks of his own Knowledge) that he himſelf had ſeen *Napkins* thereof, which being taken foul from the Board at a great Feaſt, were caſt into the Fire, by which means they were better ſcoured, and looked fairer and cleaner than if they had been waſh'd in Water.

And beſides the Teſtimony of ſeveral curious Perſons in all Ages, we have now ſeen a piece of this Linen paſs the fiery Trial both at *London* and *Oxford*.

This *lanuginous Mineral* is call'd from its ſtrange Qualities, ſometimes *Amianthus*, quod in ignem injectus non μιαίνεται; the Fire being ſo far from defiling it, that it rather gives it a Luſtre. 2. It is called *Asbeſtos*. And 3. *Salamandra*, in *Engliſh*, *Salamander's Wooll*: I ſuppoſe from the *Thryallides*, or *Candle-wicks*, ſaid to be anciently made of it, which being put into *Lamps* of *inconſumable Oyl*, would never waſte or go out; which I take to be the true Reaſon of the Impoſition of theſe Names upon it, whether there ever were any ſuch Lamps or no.

4. From a *pungent* Quality, *Agricola* ſays, it has on the Tongue without *Aſtringency*, it is called *Alumen*, having the diſtinguiſhing Epithet *Plumeum* added to it, taken from its downy Filaments, to diſcriminate it from all the reſt of them *Alums*.

5. From the light gray Colour of its lanuginous parts, it is called by ſome *Polia*, by others *Corſoides*; and from its likeneſs to the hoary Fibres of ſome ſort of *Mat-weed*, *Spartapolia*.

6. From the Capacity it has of being ſpun into Thred, it is alſo called *Linum*, with ſome diſtinguiſhing Epithet taken either from its Quality, ſuch as *Asbeſtinum*, or *Vivum*; or from the Place where found in general or particular: It being called in general *Linum Foſſile*, in *Engliſh*, *Earth Flax*, and in particular, *Linum Indicum*, *Creticum*, *Cypricum*, & *Carpaſium*, or *Caryſtium*. But beſide the Places that have given theſe Epithets to the Head made of it, it is alſo found in *Tartary*, at *Namur* in the *Low-Countries*, at *Eisfield* in *Thuringia*; amongſt the *Mines* in the old *Noricum*; ſome where in *Ægypt*; and in the Mountains of *Arcadia*, alſo at *Puteoli*, and lately in ſome *Mines* in *Italy*, and it has been yet latelier met with in a ſmall Iſland belonging to *William Robinſon* Eſq; called *Ynis Molroniad*, *i. e.* the Iſland of *Sea-Calves*, in the Pariſh of *Llan Fair Yng Hornwy* in *Angleſea* in *Wales*.

It is commonly by the *Lithographers* reckoned among Stones, but I rather ſhould judge it a *Terra Lapidoſa*, or middle Subſtance between a Stone and an Earth. But whether the one or the other, it is made of a Mixture (I gueſs) of ſome Salt or other, a pure Earth without Sulphur, coagulated in the Winter, and hardned to Perfection by the Heats in Summer; which Salt *Johannes Heſſus* proves by a very cogent Argument to be *Alumen Liquidum*

quidum, deſcribing it as *Matthiolus* alſo does, to be of a whitiſh lacteous ſubſtance, ſomewhat inclining to yellow, that ſweats out of the Earth, and ſmells like rotten *Cheeſe*, whereof having gathered a quantity at *Puteoli*, together with the other Species of *Alum*, and kept it a while by him, when he came to look on it again, he found it to have loſt the Smell, and a great part of it changed into *Alumen plumeum*, the *ſaline* Part, I ſuppoſe, ſhooting into Threads, and the pure Earth uniting them, as found in the places wherever generated; whether ſweating from the Earth, as *Pliny* and *Matthiolus* would have it, or percolated through *Rocks*, as we find it in *Wales*, the Veins of it there running through a Rock of Stone, in Hardneſs and Colour not unlike Flint.

And yet ſeems to be made of ſuch an *Alum*, as that of *John Heſſus* at *Puteoli* was, ſome of it being ſtraw-coloured, as if it ſtill retained the Yellowneſs that his liquid *Bitumen* was ſaid to have; which is a Colour not given to it by any Author, moſt of it being ſaid to be white, or cinerous; ſome of it red, and ſome of an Iron Colour, as *Agricola* tells us; and I have ſome of the *Cyprian* by me, ſent from *Aleppo*, by Dr. *Rob. Huntington*, whereof ſome is of a light Blue, or *Pearl Colour*, and ſome of it has a Caſt of *Sea-Green.*

But however the whole mineral Subſtances found at ſeveral Places may differ in Colour, yet I do not find but the woolly part of them all ſeems to be much the ſame, *viz.* of a white ſilver Colour, the Threads very fine and ſlender, yet very ponderous, the ſmalleſt Particles of them throughly wet, ſinking in Water, as I alſo found a very ſlender Thrum of the *incombuſtible Linen* given me by Mr. *Baily*, which Mr. *Waite* brought from *India*, would alſo do, which renders it very probable that it is not a Vegetable, but a mineral Subſtance, notwithſtanding the Informations of *Conco* and *Keay arear Sukradana*, mentioned in Mr. *Waite's* Letter, I ſay, renders it probable, there being ſeveral Woods, ſuch as *Box*, *Red Wood*, *Perſian Wood*, *&c.* that will ſink in Water.

De Region. Orientalibus.

Marcus Paulus Venetus acquaints us, that it is found in *Tartary* in a certain Mountain in the Province of *Chinchinthalas*, and made into Cloth, as he was informed by one *Curficar*, a *Turk*, who was Superintendent of the Mines in that Country, after this Manner; The lanuginous Mineral, or *Amianthus*, being firſt dried in the Sun, is next pounded in a braſs Mortar, and the earthy part ſeparated from the woolly, which is afterwards waſht from all Filth whatever that may ſtick to it; and ſo, being thus purged, is ſpun into Thread like other Wool, and after wove into Cloth; which if foul, or ſpotted, they cleanſe, he ſays, by throwing it into the Fire for an Hours time, whence it will come forth unhurt, as white as Snow. Which very method (as *Strabo* deſcribes it) ſeems alſo to have been uſed in ordering the *Cretan Amianthus*; only with this Addition, that after it was pounded, and the Earthy Part ſhook from the woolly, he ſays it was comb'd, and ſo does *Agricola*, which argues, there was ſome of a greater Length than any I have yet ſeen.

Of this *Linen*, as *Pliny* informs us, Shrouds were anciently uſed, at the *Royal Obſequies*, to wrap up the Corps in, ſo as that the Aſhes of their Bodies might be preſerved diſtinct from thoſe of the *Wood*, which made the Funeral Pile: And the Princes of *Tartary*, as *Keay arear Sukradana* was credibly informed (and I have it well confirmed from other Hands) do uſe ſuch at this Day for burning their Dead. It muſt be acknowledged, it does diminiſh every time it undergoes the Violence of the Fire; yet this hinders not, but it may, and will, do that Service divers times before it be rendred altogether uſeleſs. Some of the Ancients are ſaid to have made themſelves *Cloths* of it, particularly the *Brachmans* amongſt the *Indians*. The *Wicks* for the *Perpetual Lamps* of the *Ancients* were alſo made of this Subſtance; and we are told, that *Septalla*, Canon of *Milan*, had Thread, Ropes, Net-works, and Paper of it. *Marco Antonio Caſtagna*, who lately found this Mineral ſome where in *Italy*, knows how to prepare and render it tractable and ſoft; which he can thicken and make thin to what Degree he pleaſeth, and maketh it thereby, like either to a very white *Skin*, or a very white Paper. We have alſo made Paper of our *Welſh Amianthus*, but lately here at *Oxford*, which will both bear Fire and Ink well enough, the Ink only turning red by the Violence of the Fire.

To ſhew the Reaſon whence it is that this ſubſtance ſhould be ſo ſtrangely privileged by nature, we muſt conſider, that the Qualities and Power of the *Fire*, according to *Ariſtotle*, are Διακρίνειν τὰ μὴ ὁμόφυλα συγκρίνειν δὲ τὰ ὁμόφυλα; to ſeparate things of a different, and unite thoſe of a like Nature. Hence it is that the Subjects moſt apt to take Fire, and be diſſolved by it, we find to be ſuch heterogeneous bodies, in whoſe Pores the moſt ſulphurous bituminous and aqueous particles are lodged; which being ſeized by Fire, are quickly put into Motion, dilated and ſeparated, and being thus made capable of flying away, are at laſt conſumed; and diſſolve the Frame of thoſe Bodies whoſe Parts before were united by them. When theſe are fled and gone, the *Fire* naturally goes out, as having nothing now left to work upon, nothing remaining but the *Salts* and *Earth* in the form of *Aſhes*, which in all ſorts of *Compounds* are the things that reſiſt this Element moſt, and will remain after the moſt exalted Operation it can be forced to. Nor do the *Salts* only of mixt Bodies thus baffle the Force of Fire; but the *Simple* ones much more, as being more *homogeneous*, as we ſee in the *Decrepitation* of *common Salt*, and *Exſiccation* of *Vitriol*, which when the aqueous parts are once evaporated, are now a pure ſimple *homogeneous Body*, no more ſenſible of the Fire, the Decrepitation ceaſing, and nothing remaining that can be dilated any further to break the Corns of *Salt*. Now whatever the Fire cannot dilate, it cannot ſeparate, nor conſequently deſtroy, or carry any thing from it, but what is heterogeneous, and accidentally adhering to the Outſide of it; which is perfectly the Caſe of our incombuſtible Linen, whoſe Threads being altogether homogeneous, and nothing elſe but the pure *Striæ* of *liquid Alum*, as was ſhewn above, holding nothing of *Sulphur*, *Bitumen* or *Water*, or any thing that is different or *heterogeneous* to it ſelf, that can be dilated or ſeparated, it is in no poſſibility of being liable to the Fire; which may indeed paſs thro' it, as we ſee it does when it is made red hot, but can carry nothing from it, but ſuch accidental Filth as has been put upon it, or accrued by uſing.

Lapis Calaminaris, *By* Mr. Giles Pooley, n. 198. p. 672.

XCIV. The *Lapis Calaminaris*, or *Calamine*, which is digged and prepared near *Wrington* in *Somerſetſhire*, is found ſometimes in Meadows, ſometimes in arable, ſometimes in paſture, and as I have obſerved, moſt commonly in barren and rocky Ground. The Waters thereabouts are much of the ſame Colour, Taſte, Clearneſs and Wholſomneſs with other Water. The Graſs upon the Ground, and the Leaves of the Trees, are as freſh where *Calamine* lies as in any other Place. But this I obſerve, that the *Groovers* always dig for it upon, or near Hills; for they expect none in thoſe Grounds which have no Communication with Hills.

To find out a Vein, they dig a Trench till they come to the Rocks, where they expect it lies; which Trench they generally dig from the North to South, or near upon that Point, the Courſes uſually lying from Eaſt to Weſt, or at 6 a Clock, as their Term is, but ſometimes the Courſes, Seams, or Rakes, as they call them, lie at 9 a Clock, and ſometimes are perpendicular, which they call the high time of the Day, or 12 a Clock, and theſe Courſes they eſteem the beſt. Theſe *Seams* or *Courſes* run between the Rocks generally wider than thoſe of *Lead Ore*, unleſs they are incloſed in very hard Clifts, and then they are narrow as the Veins of Lead. The Colour of the Earth where the *Calamine* lies, is generally a yellow Grit, but ſometimes black; for all Countries, as they term their underground Works, are not alike.

The *Calamine* it ſelf is of ſeveral Colours, ſome white, ſome reddiſh, ſome greyiſh, ſome blackiſh, which is counted the beſt, and when this is broken it is of ſeveral Colours.

In working for it below in the Countries, they uſe the ſame way and Inſtruments, as they do in Lead Mines, and ſometimes they light upon a good quantity of *Lead*, but always find ſome Eyes of Lead among the Calamine; Though I think, in *Lead-mines*, they do not always find *Calamine*. In Landing of the *Calamine*, ſome Pieces are bigger than others, and mixt with a gritty Earth. I have been informed, that they have found one entire Piece of 8 or 10 Tun, which by Reaſon of its Bigneſs was forced to be broken in the *Groove* before it could be landed; But generally it riſeth in ſmall Particles; ſome about the Bigneſs of a Nut they call a ſmall *Calamine*. In ancient Works, *Damps* and *Steamches* ſometimes ariſe, but never in new Works.

When they have landed a good quantity of the *Calamine*, they waſh, clean, or *buddle* it as their Term is, which they perform after this manner. They encloſe a ſmall piece of Ground with Boards or Turfs, through which a clear Stream of Water runs; within this Encloſure they ſhovel and often turn their Calamine, and the impure and Earthy Parts the running Water carries away, and leaves the *Lead* and the *Calamine*, and the other heavier Stony and Sparry Parts behind. When they have thus waſhed the *Calamine*, as Clean as they can, having rak'd up the bigger Pieces both of the Lead and *Calamine*, they put the ſmaller Parts into Sieves, made of ſtrong Wire at the bottom: And theſe they often dip and ſhake up and down in a great Tub of Water, whereby the parts of the Lead which are mixt amongſt the *Calamine* ſink to the bottom of the Sieves, the *Calamine* remains in the middle, and the other Sparry and Traſhy parts riſe up to the top; which they Skim off and throw away, then they take off the *Calamine*, and after that the Lead. When they have thus cleanſed the *Calamine*, they are forced to ſpread it abroad, and ſo pick out with their Hands the Traſh and Stones that remain. But all of it does not require ſo much Trouble; for ſome riſeth big enough out of the Works to be cleanſed and pick'd fit for the *Calcining Oven* without all this Charge and Pains: And I have ſeen ſeveral Loads of this great *Calamine*, which had no Mixture of Earth or Traſh in it.

Their *Calamine* being thus Prepared they carry it to the *Oven*, which, at leaſt that which I ſaw, is much bigger than any *Baker's-Oven*, and made much in the ſame Faſhion: Only they caſt in their Coals into a Hearth made on one ſide of the *Oven*, which is divided from the *Oven* it ſelf by a Hem or Partition made open at the Top, whereby the Flame of the Fire paſſeth over, and ſo Heats and Bakes the *Calamine*. They let it lie in the *Oven* for the ſpace of 4 or 5 Hours, (the Fire burning all the while) according to the ſtrength of the *Calamine*, ſome being much ſtronger than other, and ſo requiring longer time; and while it continues in the *Oven*, they turn it ſeveral times with long Iron Coal-rakes; when it is ſufficiently burned, baked, and dried, they beat it to a Powder with long Iron Hammers, like Mallets, upon a thick Planck, picking out what Stones they find amongſt it; ſo that at loſt the *Calamine* is reduced to Duſt, and then it is fit for the Merchant.

I have been credibly informed that the Duſt of *Calamine* conduces much to the curing of Sore Eyes of Men: And that its frequently made uſe of, for the taking off Films from the Eyes of Horſes and other Beaſts.

To Vitrify Antimony *with* Cawk; *By* Dr. Mar. Liſter. n. 110. p. 225

XCV. 1. Take of *Antimony* one Pound; Flux it Clear: Have one Ounce or two of the *Cawk Stone* (by and by to be deſcribed) in a Lump Red Hot in readineſs. Put into the Crucible to the *Antimony*; continue the Flux a few Minutes; Caſt it into a clean and not greaſed Mortar, Decanting the Melted Liquor from the Cawk.

This proceſs gives us above 15 Ounces of *Vitrum* of *Antimony*, like poliſh'd Steel, and as bright as the moſt Refined Quickſilver. The Cawk ſeems not to be Diminiſhed in its Weight but rather Increaſed; nor will be brought to Incorporate with the *Antimony*, though Fluxt in a ſtrong Blaſt.

This *Cawk-ſtone* is a very odd Mineral, much a kin to the *White Milky* Mineral Juices of the Lead Mines, which Vitrifies in like manner. Beſides theſe I could never light upon any one Mineral Subſtance, which had any ſuch Effect upon *Antimony*. *Vid. Sup.* §. XLVI.

Cawk is a Ponderous White Stone, found in the Lead Mines; it will draw a White Line like Chalk or the *Gallactites*; but it is more fine and hath a ſmooth and ſhining grain, *Sparr like*, yet not at all Tranſparent.

The Vertue of Antimony; *By* . . . . n. 89. p. 774.

2. I try'd that a *Boar*, to whom I had given an Ounce of *Crude Antimony* at a time putting him into the Sty, would be Fat a fortnight before another, having no *Antimony*, upon the like Feeding. *Antimony* will Recover a *Pig* of the *Meaſles*; by which it appears to be a great Purifier of the Blood. I knew a Horſe that was very Lean and Scabbed, and could not be Fatted by any Keeping, to whom *Antimony* was given for two Months together every Morning, and that upon the ſame Keeping he became exceeding Fat. One of my own Horſes having had the *Faſſions*, and being cured, had notwithſtanding extream running Legs; ſo that after he had paſſed the Courſe of Ferriers twice, to be cured, it was not done; but upon my giving him *Antimony* one Week, he was preſently healed.

The manner of uſing it, is this. Take one *drachm* of *Crude Antimony* powder'd for one Horſe, and when you give him his Oats in a Morning, ſhake it out amongſt his Oats: or make it in Balls.

A Black Shining Sand, *from* Virginia; Examined *by Dr.* All. Moulen. n. 197. p. 624.

XCVI. A ſmall Vial fill'd with ordinary White Sand, and containing only ℔. i. *gr.* xi. being fill'd with the *Virginia Sand* was found to contain ʒ ij. ℈ij. *gr.* I.

This Sand did apply to the Magnet both before and after Calcination; but the latter did apply better to it than the former.

A Parcel of this Sand mixed and Calcin'd with powder'd Charcoal, and kept in a Melting Furnace for about an Hour, yielded no *Regulus*: but apply'd more vigorouſly to the *Loadſtone* than either of the former.

I Flux'd a Parcel of this *Sand* with *Fix'd-Nitre*, in a Melting Furnace for above an Hour, but could obtain no *Regulus*; nor any ſubſtance that would apply to the *Magnet*, excepting a thin Cruſt that ſtuck firmly to a piece of Charcoal that dropt into the *Crucible* when the Matter was in *Fuſion*.

I Flux'd it alſo with *Salt Petre* and *Powder'd Charcoal*, droping pieces of Charcoal afterwards into the *Crucible*. It continued about an Hour in the Melting Furnace in *Fuſion*, and that without producing a *Regulus*, or a Subſtance that would apply to the *Magnet*, excepting only what ſtuck to the Charcoal, as in the former Experiment.

I Flux'd another Parcel of it with *Salt-Petre* and *Flowers* of *Brimſtone*, without being able to procure any *Regulus*.

I pour'd good *Spirit* of *Salt* on a Parcel of this Sand, but could obſerve no *Luctation* thereby produced.

I pour'd *Spirit* of *Nitre*, both ſtrong and weakned with Water, on Parcels of the ſame Sand, without being able to diſcover any Conflict.

I pour'd *Single Aqua Fortis* upon another Parcel of it, without being able to perceive any *Ebullition* worth noting.

I pour'd *Double Aqua-Fortis* upon another Parcel of it, which, for ought I could Diſcover, had no more Effect on it than the former.

I pour'd alſo ſome *Aqua-Regia* on a Parcel of it, without diſcovering any ſenſible effect. I pour'd good *Oyl* of *Vitriol* upon another Parcel of this Sand, but ſeeing no Bubbles thereby produc'd, I weaken'd the Oyl with Water, but without any ſenſible Effect.

I repeated all the former Experiments with the *Menſtruums* upon this *Sand* after *Calcination per ſe* in a *Crucible*, but could ſcarce obſerve a Bubble produc'd by any of them.

I pour'd ſome of each of the Liquors upon Parcels of the Powder of this Sand Calcin'd, without any Succeſs.

Note, That I made theſe Experiments both in the Cold, and upon a Sand-Furnace. So that to me there ſeems to be but little wanting to diſcover any Metal known to us, if it contained any ſuch: for there is no Metal nor Oar that ſome of theſe *Menſtruums* will not work on.

I Powder'd a Fragment of a Loadſtone, and pour'd ſome of theſe *Menſtruums* upon it, without being able to find that they in the leaſt prey'd upon it, any more than they did upon the Sand.

I pour'd ſome of the afore-mention'd *Menſtruums* upon ordinary Sand taken out of a *Sand-Furnace*, where it muſt have ſuffer'd ſome Calcination, but could find no more Bubbles produced thereby, than what mighr rationally be ſuppos'd to be produc'd from Lime, and other Dirt mixt with the Sand.

XCVII. The Black Sand, which in *Italy* they uſe inſtead of Duſt to their Letters, is found 6 Miles from *Genes* near St. *Piere d'Araine* on the Sea-ſhore. It hath the Properties of the *Loadſtone*, and I do believe that it is *Loadſtone*, or Powder of *Loadſtone*, for it followeth the *Loadſtone*; it ſticketh to a Knife that is touched with the *Loadſtone*; it draweth a *Magnetick Needle*; it doth not Ferment with *Aqua Fortis*, as Iron Duſt doth; it doth not Ruſt with any *Acid* that can be put to it; it doth not Sparkle in the Flame of a Candle, as Steel-Duſt doth, when it is thrown into the Flame. It is commonly found on the Sea-Shoar after Great Storms.

A Black Sand *from* Italy; *By Mr.* Butterfield. n. 244. p. 356

XCVIII. A certain Powder lately invented in *Germany* maketh Metal ſo Cloſe and Smooth, that it leaves not the leaſt Pit in the Piece; a Gun ſo caſt needs no Boaring, and one third of the Metal may be ſpared. Such Guns remain Clean and Neat a long while. *July* 9. 1672. there was caſt a *Demy-Cannon*, Weighing 34 Hundred, which was Tryed with a Bullet of 34. lb. and the firſt time 12. lb. of ſtrong Powder, the ſecond time as much, the third time 15. lb. and the fourth time 24. lb. all which it endur'd very well. With a ſmall *Petard*, of 2. lb. of this Metal, I broke in pieces a beam of a Rhine Foot ſquare, the Petard remaining Entire and Perfect. This Powder is not only eaſie to make, but alſo of ſmall Expence,

To make Metal Run Smooth *and* Cloſe; *By a* at Franckfort *on the* Main. n. 94. p. 6040.

XCIX. The

Iron Works in Gloceſter-ſhire; By Mr. Hen. Powle. n. 137 p. 931

XCIX. 1. The Foreſt of *Dean* (lying betwixt the *Wye* and *Severn*) conſiſts generally of a *Stiff Clay*. The Country is full of Hills, but they are no where high: Betwixt them run great ſtore of little Springs, of a more browniſh Colour than ordinary Waters, and often leave in their Paſſage Tinctures of Ruſt. The Ground is naturally inclin'd to Wood, eſpecially *Haſle* and *Oak*; but 'tis now almoſt devoured by the Increaſe of the *Iron-Works*. Upon the Surface of the Earth, in many Places, lie an abundance of Rough Stones, ſome of them of a vaſt Bulk; but where they ſink their Mines, they rather meet with Veins of *Scaly Stone*, than hard and ſolid Rocks. Within the Foreſt they find great plenty of *Coal* and *Iron-Ore*; and in ſome places Red and Yellow *Oker*.

The *Iron-Ore* is found in great abundance in moſt parts of the Foreſt; differing both in Colour, Weight, and Goodneſs. The beſt, which they call their *Bruſh-Ore*, is of a bluiſh Colour, very Ponderous and full of little ſhining ſpecks like Grains of Silver. This affords the greateſt quantity of *Iron*: but being Melted alone produceth a Metal very Short and Brittle. To Remedy this inconveniency, they make uſe of *Cynder*, which is found in great Quantities through all parts of the Country, where any former *Works* have ſtood; for in former Times, their Bellows being mov'd only by the ſtrength of Men, their Fires were much leſs Intenſe than in the Furnaces they now Employ: So that they Melted down only the Principal part of the *Ore*, and rejected the reſt as uſeleſs. This is call'd *Cynder*, and being mingled with the *Ore* in a due Quantity, gives it that Excellent Temper of *Toughneſs*, for which this *Iron* is preferr'd before any that is brought from Foreign Parts.

The *Ore* is firſt *Calcined* in *Kilns*, much after the Faſhion of Ordinary *Lime Kilns*; which they fill up to the Top with *Coal* and *Ore*, *Stratum ſuper Stratum*: Then putting Fire to the bottom, they let it Burn till the *Coal* be waſted. This is done without *Fuſion* of the *Metal*; and ſerves to conſume the more Droſſy parts of the *Ore*, and to make it friable. From hence they carry it to their Furnaces, which are built of Brick or Stone, about 24 Foot ſquare on the out ſide, and near 30 Foot in height. Within not above 8 or 10 Foot over in the middle, the top and bottom having a Narrower Compaſs, much like the ſhape of an Egg. Behind the Furnace are placed two huge Pair of Bellows, whoſe Noſes meet at a little hole near the Bottom. Theſe are compreſſed together by certain Buttons, placed on the *Axis* of a very large *Overſhot Wheel*.

The Furnaces are at firſt filled with *Ore* and *Cynder* intermixt with *Fuel*, which in theſe Works is always of *Charcoal*; laying them hollow at the bottom, that they may more eaſily take fire: But after they are once kindled, the Materials run together in a hard Cake or Lump which is ſuſtained by the Faſhion of the *Furnace*, and through this the Metal, as it Melts, trickles down into the Receivers, where there is a Paſſage open, by which they take away the Scum and Droſs. Before this lies a great Bed of Sand, wherein they make furrows of what Faſhion they pleaſe; into theſe they let in their *Metal*; which is made ſo very fluid by the violence of the Fire, that it continues Boiling for a good while. The *Furnaces* are kept at work Night and Day for many Months; ſtill ſupplying the Waſte of the *Fewel* and other Materials with Freſh, poured in at the top.

From theſe *Furnaces*, they bring their *Sows* and *Pigs* of *Iron* (as they call them) to their *Forges*. Theſe are of two ſorts, though ſtanding together under the ſame Roof : one they call their *Finery*, the other the *Chafery*. Both of them are upon Hearths, on which they place great Heaps of *Sea-Coal*, and behind them Bellows, like to thoſe of the *Furnaces*, but nothing near ſo large. Into their *Finery*, they firſt put their *Pigs* of *Iron*, placing 3 or 4 of them together behind the *Fire*, with a little of one end thruſt into it: Where ſoftning, by degrees, they ſtir and work them with long Bars of Iron, till the Metal runs together into a round Maſs or Lump, which they call a *Half-bloom*. This they take out, and giving it a few Strokes with their Sledges, they carry it to a great Weighty *Hammer*, raiſed likewiſe by the motion of a Water-wheel: where applying it Dexterouſly to the Blows, they preſently Beat it out into a thick ſhort Square. This they put into the *Finery* again, and heating it red hot, they work it out under the ſame Hammer, till it comes to be the ſhape of a Bar in the middle, with two ſquare Knobs on the Ends. Laſt of all they give it other Heatings in the *Chafery*, and more Workings under the Hammer till they have brought their *Iron* into Bars of ſeveral ſhapes and ſizes. If they Omit any one Proceſs it will be ſure to want ſome part of its Toughneſs, which they eſteem its Perfection.

For the Backs of Chimneys, Hearths of Ovens, or the like, they take the Melted Metal out of the Receivers in great Ladles, and pour it into Moulds of fine Sand.

2. 1. At *Milthrop Forge* in *Lancaſhire*, they have ſeveral ſorts of *Iron Stone*; ſome of it making Coldſhire Iron, that is ſuch as is Brittle, when it is Cold; another ſort makes Redſhire, that is ſuch as is apt to Break if it be Hammered, when it is of a dark red Heat; and therefore they are never melted down but in Mixture, and ſo they yield an indifferent good ſort of Iron. They have of late made it much better than heretofore, by Melting the Sow-Metal over again, as likewiſe by uſing *Turf* and *Charcoal*, whereas formerly their fuel was only *Charcoal*. They firſt burn the Iron Stone; and then for every 17 Baskets of this burnt Stone they put in one of *Limeſtone* unburnt to make it melt freely, and caſt the Cynder; which they always take off from the Melted Iron, before they let it Run.

In Lancaſhire; *By Mr.* John Sturdy n. 199. p. 695

The Bottom of the *Furnace* is about 2 Yards Square, and ſo riſes Perpendicular for a Yard or more, which is alſo lined within with a Wall of the beſt Fire-Stone, to keep off the force of the Fire from the Walls of the *Furnace*. The Bellows (which are very large and played with Water) enter about the middle of the *Focus*. The reſt of the *Furnace* is raiſed upon this, 6 or 7 Yards, Square-wiſe, but Tapering; ſo that the Top hole (where they throw in Baskets of Stone and Fewel) is but $\frac{1}{2}$ a Yard Square. When they find it to have ſubſided about a Yard and $\frac{1}{2}$ then they fill the *Furnace* again, The *Ore* is got in *Furneſs* (a Diviſion of *Lancaſhire*) at leaſt 15 *Miles* from *Milthrop*. Some of it is hard, but feels Soft and Smooth on the out-ſide, like Velvet. Some is ſoft as Clay, but all is Red; and one ſort ſeems to be good *Hæmatites*.

Ib. p. 697. 2. The Forge is very much like that of a common Black Smiths, about 1½ Yard over, and the ſame height. The Hearth is all of *Sow-Iron*, much of the ſhape of a broad brim d Hat, with the Crown downwards. This hollow Place they fill and upheap with *Charcoal*, and lay the *Ore* (firſt broken into pieces as big as a Pigeons Egg) all round about the *Charcoal* upon the flat Hearth to bake it, as it were, or Neal it, and thruſt it in by little and little into the hollow, and keep Blowing for ſome 12 Hours. Then they pull out a Stopple at the Bottom of the Wall, and out comes all the *GlaſſieCynder* being very Liquid, leaving the Iron (which is never in a perfect *Fuſion*) in a Lump at the Bottom. This they take out with great Tongs, and turn it under heavy *Hammers* (played with Water) which at the ſame time beat off, or rather ſqueeze out, the fluid *Scoria* (eſpecially at firſt taking out of the *Furnace*) and Form it after ſeveral heats into Barrs. They uſe no *Limeſtone* or other things to promote the Flux. They get about an Hundred weight of Metal at one Melting, which is the Product of about 3 times ſo much *Ore*.

Ib. p. 699. *Steel* is not made from that they call *Steel Ore*, but *Iron*, ſuch as is made from the reſt.

The ſeveral ſorts of *Ores* lie in one *Vein*, which is ſometimes an *Inch*, ſometimes a Foot, and ſometimes 3 or 4 Yards Broad, and many Fathoms deep, between Grey *Limeſtone* Rocks; but the hard *Ores* lie uſually next the Rocks on each ſide, and the Soft *Ore* in the midſt. They uſe the Soft *Ore* frequently and with good Succeſs, as a Medicine for the *Murrain* in Cattle, and for all Diſeaſes in *Swine*, to which laſt they will give a good handful or two in Milk.

By *Dr*. Liſter. ib. 3. This *Clay Hæmatites* is as good, if not better, than that which is brought from the Eaſt-Indies; Witneſs the *Tea-pots* made of it in *Staffordſhire*.

The True Way of making of Steel; By Dr. Mart. Liſter. n.103. p.865 *Vid. inf. Vol.* III. *par.* II. *Cap.* II. § XLIV. C. Thoſe Famous and Stupendious Monuments of *Antiquity*, the *Ægyptian Obelisks* are all of *Porphyry*, and moſt of them curiouſly Carved with a vaſt number of Figures; one way of Writing of the Ancient *Egyptians*: Theſe Witneſs the Facility that Nation had of Graving in *Porphyry*; a Stone which no *Tool* will now *Touch*, nor nothing leſs Affect, than *Emery* or *Diamant Powder*.

Mr. *Ray* aſſures us, that all the *Obelisks* of *Rome*, that are *Graven* with *Hieroglyphicks*, are of one and the ſame kind of Stone, *viz.* a *Marble* of a mingled Colour, Red and White, very Hard, and hath not in ſo many Ages Suffered the leaſt by the Weather.

Something there is certainly loſt in this Age, as to the manner of *Steeling* of *Tools*: And the *Proceſſes* now uſed by moſt Nations, are Fraudulent, and

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a Poiſoning of Iron, by certain *Mineral Salts*, rather than a true Making of *Steel*.

Ariſtotle tells us, “That wrought Iron it ſelf may be caſt ſo as to be made *Liquid*, and to Harden again: And they are wont to make Steel thus: For the *Scoria* of *Iron* ſubſides, and is purged off by the bottom. And when it hath been often Defecated, and made clean, this is Steel. But this they do not often, becauſe of the much waſte, and for that it loſes much Weight in *Fining*. But Iron is ſo much the more Excellent, the leſs *Excrement* it hath.” This Account is a little confuſed, and not well underſtood: It is indeed True, that Iron is ſtill better, the more it is Purged. It is as true that even wrought Iron may be melted as often as you pleaſe; and as oft as it is melted and Purged, it loſeth much of its Weight. But after all, Iron of it ſelf, how oft ſoever it is Purged and Refined, will never become Steel; yet of this ſo Purged, the beſt Steel doubtleſs may be made. Meteor l 4. c. 6.

The manner of making True Steel, is thus faithfully deſcribed by *Agricola*. And this way by *Kircher* is ſaid to be now in uſe in the Iſland of *Ilva*, a Place famous from all Ages, even from the Times of the *Romans*, for that Metal alone, down to our Days. De re Metal. l. 9.

“Make choice of *Iron* which is apt to Melt, and yet hard, and yet which may eaſily be wrought with the Hammer, for although Iron which is made of *Vitriolick Ore*, may melt; yet it is Soft, or Fragil, or Eager. Let a Parcel of ſuch Iron be heated red Hot, and let it be cut into ſmall Pieces, and then mixt with that ſort of Stone, with eaſily melts; then ſet in the Smith's Forge or Hearth, a *Crucible* or Diſh of *Crucible Metal*, a Foot and an half Broad, and a Foot deep; fill the Diſh with good *Charcoal*, and Compaſs the Diſh about with looſe Stones, which may keep in the Mixture of Stone, and Pieces of Iron put thereon.

“As ſoon as the Coal is throughly kindled, and the Diſh is red Hot, give the Blaſt, and let the Workman put on by little and little, all the Mixture of Iron and Stone he purpoſes.

“When it is Melted, let him thruſt into the middle of it, three or four, or more pieces of Iron, and boil them therein 5 or 6 Hours, with a ſharp Fire; and putting in his Rod, ſtir often the Melted Iron, that the Pieces of Iron may imbibe the ſmaller Particles of the Melted Iron, which Particles Conſume, and thin the more groſs Particles of the Iron Pieces; and are as it were, a Ferment to them, and make them tender.

“Let the Work-man now take one of the pieces out of the Fire, and put it under the great Hammer to be drawn out into Bars, and wrought, and then, hot as it is, forthwith plunge it into Cold Water.

“Thus Tempered, let him again Work it upon the *Anvill* and break it; and looking upon the Fragments, let him conſider whether it look like Iron in any part of it, or be wholly condenſed, and turned into Steel.

“Then let the Pieces be all Wrought into Bars; which done, give a freſh Blaſt to the Mixture, adding a little freſh Matter to it, in the room of that which had been Drunk up by the Pieces of Iron; which will Refreſh and Strengthen the Remainder, and make yet Purer the Pieces of Iron again

“ put into the Diſh: Every one of which let him, as ſoon as it is red hot,
“ beat into a Bar, upon the Anvil, and caſt it hot as it is into Cold Water.
“ And thus Iron is made into Steel; which is much harder and whiter than
“ Iron.

Lib. 34. c. 14. *Pliny*, ſpeaking of *Iron*, ſays, *Fornacum maxima Differentia eſt: in iis equidem* Nucleus Ferri *excoquitur ad Indurandam Aciem, alioque modo ad Denſandas* Incudes Malleorumve Roſtra. From this Paſſage it ſhould ſeem, that the *Ancients* had one way to make Steel, and another way to Harden or Temper their Tools, particularly ſuch as Picks and Anvils. And it is plain that the *Nucleus Ferri* (by which muſt be meant well purged Iron; the ſame which *Ariſtotle* calls ἐργασμένος σίδηρος) was melted down in both. But in my Opinion with this difference, in making Steel, they not only boyl'd their Iron in its own Sow-Metal, or Liquid Iron, but Hammer it alſo, and after Quench it in Cold Water.

And this Opinion thoſe other words of *Pliny* in the next Chapter favour, *Ferrum accenſum Igni, niſi Duretur* Ictibus, *corrumpitur*: And again, *Aquarum ſumma Differentia eſt, cui ſubinde* Candens immergitur. And this way was ſufficient for *Sword-Blades*, and *Knives*, *Razours*, *&c.* Whereas in Steeling their Tools, they boiled their Tools in Sow-Metal, to ſuch a Degree of Hardneſs or Temper, as was Requiſite, and did not afterwards Hammer them. For Iron this way made into Steel, becomes a kind of *Electrum*, and is filled with an exceeding Brittle and hard Body; for which purpoſe the Word *Denſare* is, by *Pliny*, aptly and Elegantly uſed. And this way was uſed when the ſtrongeſt Temper and Hardneſs was required; as to Picks and Anvils: For it is certain that Steel, as well as Iron, by *Ignition*, is ſpoiled or corrupted. Hence it was that the Antients well knowing that in making their Tools out of Steel, they could not but conſiderably loſe and abate of their Temper; they firſt ſhaped them, and then gave them a ſtrong Body of Steel and Temper together, and ſo had nothing elſe to do but to finiſh them on the *Grindſtone* and *Hone*, to ſet the Point or Edge.

Copper Mines in Hungary; By Dr. Edward Brown. n. 59. p. 1042.

CI. 1. *Herrn Ground* is a little Town in *Hungary*, ſeated very high between two Hills, upon a part of Land of the ſame Name, an *Hungarian Mile* diſtant from *Newſol*. In this Town is the Entrance into a large Copper Mine, very much digged.

I went in through a *Cuniculus*, call'd *Tash-ſtoln*. The ſteep Deſcents are made by Ladders or Trees ſet upright, with deep Notches or Stairs cut in them to ſtay the Foot upon. They are not troubled with Water, the Mine, lying high in the Hill: But they are moleſted with Duſt and Damps.

The Veins of this Mine are large, many of them Cumulate, and the *Ore* very Rich; in an hundred Pounds of *Ore*, they ordinarily find twenty Pounds of Copper; ſometimes thirty or forty, half Copper, and even to ſixty in the Hundred. Much of the *Ore* is joined ſo faſt to the Rock, that it is ſeparated with much Difficulty. There are divers ſorts of *Ore*; but the chief difference is between the Yellow and the Black; the Yellow is pure Copper *Ore*, the Black contains alſo a Proportion of Silver.

They find no Quickſilver here; the Mother of the Ore is Yellow, and the Copper Ore heated and caſt into Water, maketh it become like that of ſome Sulphureous Baths.

They ſeparate the Metal from the Ore with great difficulty. The Ore commonly paſſes 14 times thro' the Furnace: Sometimes it is burned and other times melted, ſometimes by it ſelf, and ſometimes mixed with other Minerals and its own Droſs.

There are divers ſorts of Vitriol found in this Mine, Green, Blue, Rediſh and White. There is alſo a Green Earth, or ſediment of a Green Water called *Berg grun*; there are likewiſe Stones found of a beautiful Green and Blue colour, and one ſort on which *Turcoiſes* have been found; therefore called the Mother of the *Turcois*.

There are alſo two Springs of a *Vitriolate Water*, which are affirmed to turn Iron into Copper; they are called the *Old* and the *New Zimeut*; theſe Springs lie deep in the Mine: The Iron is ordinarily left in the Water 14 days; I took divers pieces formerly Iron, now appearing to be Copper, out of the *Old Zimeut*; they are hard within the Water, and do not totally loſe their figure, and fall into Powder, they will eaſily melt without the addition of any other ſubſtance.

They make handſome Cups and Veſſels out of this ſort of Copper.

2. There is a heap of Copper Ore by *Darwent* near *Keſwick*, but I ſuppoſe the Weather hath eaten out all the Copper that was in it: It is reported, that the thickneſs of the Vein at *Gouldſcope* in *Newlands* was 6 Foot; there is no Shafts now in being either at *Newlands* or *Caldbeck*, there are divers Adits, but they are uſeleſs, the Workmen having wrought down the Ore far below them; there is part of an Adit wrought at *Caldbeck*, but it is uncertain what it may coſt finiſhing; for ſome Stone may be wrought for 20 Shillings a Fathom, and ſome of it may prove ſo hard, that it may coſt 10 Pound a Fathom.

In Lancaſh're *and* Cumberland

By Mr. Dav. Davies, *to Dr.* Liſter. n. 200 p. 737.

A Thouſand Pound Stock will be enough to begin with, to get Ore at *Caldbeck* Mines, and then there muſt be Smelting Houſes built, which coſt 500 Pound or more; and before Copper be made ready for ſale at the Market, and the Work come to pay it ſelf, it will be 6 or 7 Years at leaſt, and by that time 10000 Pound will be Stock little enough.

3. The firſt Work that was found, and wrought in by the *Dutch-men*, in *Coniſton Fells*, is called *Low Work*, it hath a Stulm or Shaft to draw Water from the Mine. This Work was left good, and had been wrought from the Day to the Evening End of the ſaid Work 40 Fathoms, or thereabouts; the Seam or Vein of Copper Ore then left was above 3 quarters of a Yard thick of good Ore; which Seam or Vein did go from the Evening End to the Morning End of the ſaid Work, and was eſteemed 200 Fathoms betwixt, wrought as the Vein went, and was, when left, all near of a breadth or thickneſs. The Copper Ore in this Work was mixed with ſome Silver or Lead Ore.

By [illegible] *to Dr* Liſter. ib p. 741.

The Second Work is called White Work or New Work, about 40

Fathom from the firſt, was wrought about 10 Fathom deep; the Seam then left was about 22 Inches of good Copper Ore.

The Third is called *Tung-Brow*, a little diſtant from the laſt, being wrought about 30 Fathom, and the Seam about two foot thick of the like Ore.

The Fourth is called *God's Bleſſing*, or *Thurdlehead*, being wrought about 30 Fathom, and being from the laſt Mine about a mile, the thickneſs of the Seam of Ore above a Yard, when left off, and thought to be much of it Gold Ore.

The Fifth, called *Hen-Cragg*, is a Mile from the laſt, wrought about 2 Fathoms; a ſmall Seam, but excellent Ore.

The Sixth Work is called *Suny Work* at *Levers Water*, at the Water-ſide, and a little above that, *Hanch Clockers-work*; a little above that, *George Towers* and *William Dixſon*'s Work; *Bartle Clocker*'s Work; near the laſt, *Richard Tower*'s Work; then *John Saclook*'s Work, and *Hanch Mire*'s Work; being all Seven Works, and lie altogether, and about a Mile from the Fifth Work aboveſaid; and Wrought about 10 or 12 Fathom; the Seam of *Ore* about 16 Inches thick; the Stone very ſoft, and the *Ore* very rich, and much of the ſaid *Ore* Green. If the *Turn* was drained (its thought) that all theſe 7 Works would come into one, and that it would be the beſt Work that ever was in theſe Parts.

The Seventh Work is called *Gray-Cragg-Beck*, wrought but a little, the Seam about 18 Inches thick, of as good *Ore* as any of the other Works.

The Eighth is called *John Dixon*'s Work in *Brumfell*, was wrought about 2 Fathom, the Seam about 24 Inches thick, and eſteemed the beſt *Ore*, except God's Bleſſing. It is about half a Mile from the laſt Work.

The Ninth Work is called the *Wide Work*, or *Thomas Hirn*'s Work, wrought about 60 Fathom, and left a Seam above 26 Inches thick, when the *Work* was given over, of very good Ore. It has a Shaft or Pump to draw the *Water* away, and it is from the laſt *Work* about 2 Miles.

The *Tenth Work* is called *Three Kings* in *Tilbiurthwait*, being 3 *Work*, and wrought above 40 *Fathoms* a piece, the Seam being above 14 Inches of very good Ore.

Theſe are all the *Works* that have been wrought in *Coniſton-Fells*. Moſt of them have ſmall Seams near the *Copper*, of a Grey ſort of Ore in ſmall Threads.

There are lately diſcover'd 3 Veins in *Torverwell*, and about 10 in other Places, and all within two Miles of the *Firſt Work* in *Coniſton Fells*, and as Hopeful as thoſe that have been wrought in.

When the *Ore* which was got at *Coniſton*, came to be ſmelted at *Keſwick*, they found it ſo much to exceed the Copper Ore of either *Caldbeck* or *Newlands*, that they let fall theſe *Works*, and ſent the Workmen to *Coniſton Fells*; ſo that there was one Hundred forty Men kept conſtantly at the Works there; and the Ore that they got, did ſufficiently furniſh and ſupply the *Smelt Houſes* at *Keſwick*.

The Rate that was given for getting of *Copper Ore*, was according to its Goodneſs, from 8 *Shillings* a *Kibble* to 2 *Shillings* and *ſix pence*, every *Kibble* being near a *Horſe Load* in weight, it being firſt beaten very ſmall, waſhed and ſifted thro' an iron Sieve, then meaſured or weighed.

There was near the *Firſt work* a *Stamp-houſe*, which went by *Water*, and ſeveral Perſons were employed to bring the *Refuſe* from each Work, that the *Miners* did throw away, to the *Stamp-houſe*, where it was ſtamped, waſhed, and order'd, and they had 2 *Shillings* and 6 *pence* for their Pains.

CII. *Calamine* is digged out of ſeveral Mines in the Weſt of *England* (as about *Mendipp*, *&c.*) about 20 Foot deep. It is burned or calcined in a *Kiln* or *Oven* made red hot, then ground to Powder, and ſifted into the Fineneſs of Flower, then mix'd with ground Charcoal, becauſe the *Calamine* is apt to be clammy, to clod, and not ſo apt or capable of incorporating. Then they put about 7 *Pound* of *Calamine* into a melting Pot, of about a *Gallon* content, and about 5 Pound of *Copper* uppermoſt; the *Calamine* muſt be mixt with as many Coals as will fill the Pot. This is let down with Tongs into a *Wind Furnace*, 6 Foot deep, and remains 11 Hours therein; they caſt off not above twice in 24 Hours. One *Furnace* holds 8 *Pots*. After melting, it is caſt into *Plates* or *Lumps*.

To make Braſs, by Mr. *Tho.* *Povey*, n. 200 p. 735. n. 260. p. 474

45 Pound of *Raw Calamine* produces 30 Pound burnt or calcin'd.

Braſs Shruff ſerves inſtead of ſo much *Copper*, but this cannot always be procured in Quantities, becauſe it is a Collection of Pieces of old Braſs, which is uſually procured in ſmall Parcels.

The beſt *Guns* are not made of *malleable Metal*, and cannot be made of pure *Copper* or *Braſs*, but it is neceſſary to put in courſer Metals to make it run cloſer and ſounder, as *Lead* and *Pot-metal*; *Bell-metal* being *Copper* and *Tin*; and *Pot-metal Copper* and *Lead*. About 20 Pound of *Lead* is uſually put into a 100 Pound of *Pot-metal*; but about 6 Pound is ſufficient to put into 100 Pound of *Gun-metal*.

The *Calamine Stones* were heretofore fetched from *Poland*, but ſince fetched from hence by the *Dutch*.

The Manufacture of *Braſs* was privately kept in *Germany* for many hundred Years; wherein many Thouſands were employed, and all were maintained; ſome having thereby raiſed themſelves to great Eſtates.

CIII. It is ſuppoſed by the *Miners*, that there was a great Concuſſion of the *Waters* in that *Separation of the Waters from the Waters* at the *Creation*, when the dry Land firſt appeared, or at *Noah's Flood*, or at both times: Whereby the Waters moved and removed the (then) Surface of the Earth. That till then the uppermoſt Surface of mineral Veins, or Loads, did (in moſt Places) lie even with the (then real, but now imaginary) ſurface of the Earth, which is now called the *Shelf*, or *Faſt Country*, or Ground that was never moved. But at this Concuſſion of the Waters, the ſurface of the Earth, together with the uppermoſt of thoſe Mineral Veins, were looſed, and torn off, and by the deſcending of the Waters into the Valleys, both the Earth, or

The Tin Mines *in* Devonſhire, *and* Cornwal by . . . n. 69 p. 2096.

Grewt, and thoſe Mineral Stones or Fragments ſo torn off from their Loads (which are conſtantly termed *ſhoad*) were, together with, and by the Force of the Waters carried beneath their proper Places, and from ſome Hills, even to the Bottoms of the neighbouring Valleys; and from thence by Land, Floods many Miles down the Rivers.

Trayning a Load. 1. Upon theſe Suppoſitions, we proceed in Trayning a Load, thus;

1. Where we ſuſpect any Mine to be, we diligently ſearch that Hill and Country, that we may the better know the *Grewt* and *Stones*, when we meet with them at a Diſtance in the neighbouring Valley.

2. Then we obſerve the *Frets* in the Banks of Rivers that are newly made by any great Land-Flood, which uſually are then very clean, to ſee, if happily we can diſcover any *metalline Stones* in the Sides or Bottoms thereof, together with the Caſt of the Country, (*i.e.* any Earth of a different Colour from the reſt of the Bank) which is a great help to direct us, which ſide or Hill to ſearch into. The *mineral Stones* are diſcovered either by their Ponderouſneſs, or by their *Poroſity*, for moſt *Tin ſtones* are porous, not unlike great Bones, almoſt throughly calcined; yet *Tin* ſometimes lies in the firmeſt Stones: or by *Vauning*, which is performed by pulveriſing the *Stone* or *Clay* or what elſe may be ſuſpected to contain any mineral Body, and placing it, on a *Vauning Shovel*; the Gravel remains in the hinder Part, and the Metal at the Point of the Shovel, whereby the Kind, Nature, and Quantity of the *Ore* is very nearly gueſs'd at.

3. If no *Shoad* be found in theſe *Frets*, we truſt not to any found in the River, it being uncertain from whence the Water may have brought them. But we go to the ſides of thoſe Hills moſt ſuſpected, where there may be a conveniency of bringing a little ſtream of Water, the more the better, and cut a *Leat*, *Gurt*, or *Trench*, about 2 Foot over, and as deep as the Shelf, in which we turn the Water to run 2 or 3 Days, by which time the Water, by waſhing away the Filth from the Stones, and the looſer parts of the Earth, which eaſily diſcover what Shoad is there. If we find any, we have a Certainty of a Load in the upper Part of the Hill, or at leaſt a *Squat*.

4. Sometimes Shoad may be found upon the open ſurface of the ground, but then 'tis brought thither by ſome Accident, for the Corruption of Vegetables and other Creatures, have in a long Tract of Time ſince the Deluge, begotten a new ſurface, heightned in ſome places a Foot or more above the Shelf; and this is demonſtrable to the Eye in every *Tin Work*.

5. At the Foot or Bottom of the Hill, we ſink an *Eſſay Hatch*, or a Hole about 6 Foot long, and 4 Foot broad, and always as deep as the Shelf. If we find no Shoad before, or when we come to the Shelf, there is none to be expected: Yet ſometimes the Shoad is waſhed away clean, when you come within 2 or 3 Foot from the Load, which then lies ſo much farther up in the Hill. If we find Shoad, we are almoſt at a certainty; And this is held as an infallible Rule, that the nigher the Shoad lies to the Shelf, the nigher the Load is at Hand, *& vice verſa*.

6. If we find no Shoad in this firſt Hatch, we aſcend commonly about 12 Fathom, and ſink a ſecond hatch, as the former. And in caſe none appear in

this; we go then as many *Fathom* on each Hand at the ſame Height, and ſink there as before; and ſo aſcend proportionably with three or more *Hatches*, if the ſpace of Ground requires, as it were in Breaſt, till we come to the Top of the Hill, and if we find none in any of theſe *Hatches*, then farewell to that Hill.

7. But if we find any Shoad in any of theſe *Hatches*, we keep our aſcending *Hatches* in a direct Line; and as we draw nearer the *Load*, we leſſen our firſt Proportion of 12 *Fathom*, to ſix or leſs, as our Conjecture guides us.

8. If finding Shoad lying near the *ſhelf* in one Hatch, and none in the next aſcending, we conclude that we have certainly over-ſhot the Load; and then we ſink nigher that Hatch, wherein we laſt found Shoad.

9. Sometimes we find two different *Shoads* in the ſame *Hatch* at different Depths, and then we have a certainty of another *Load* above the former; and it may be in training up to the ſecond, we meet with the Shoad of a third. Some *Tinners* affirm, that 7 Loads may lie parallel to each other in the ſame Hill, but yet one only *Maſter-Load*; the other 6, three on each ſide, being the leſſer Concomitants. So may 5 lie in like Manner; three are common.

10. Every Load has, as it were, a peculiar coloured Earth or *Grewt*, about it, which is found likewiſe with the Shoad in a greater Quantity, the nearer the Shoad lies to the Load, and ſo leſſened by degrees to about a ¼ of a Miles Diſtance; farther than which, that peculiar *Grewt* is never found with the Shoad.

11. A Valley may ſo lie, as at the Feet of 3 ſeveral Hill: and then we we may find 3 ſeveral *Deads*, i. e. *Common Earth*, or that looſe Earth which was moved with the ſhoad in the Concuſſion, but not contiguous to the *Load* in its firſt Poſition, which is alſo termed by us the *Run* of the *Country*, with as many different Shoads in the midſt of each. And here the Knowledge of the *Caſt* of the *Country*, or each Hill, in Reſpect of its *Grewt*, will be very neceſſary, for the ſurer *Training* of them one after another, as they lie in Order, according to the foregoing Rules of *Eſſay Hatches*; for the uppermoſt will direct you, with which Hill to begin firſt.

12. It may be, that after we have trained up the Hill, inſtead of a *Load*, we find nought but a *Bonny* or *Squat*, which likewiſe have their *Shoad*, whoſe Form is about 2 or 3 Fathom long, and half as broad; few larger, moſt leſs, which communicates with no other Load or Vein, neither doth it ſend forth any of its own, but is entire of it ſelf, and may go down into the Shelf 5 or 6 Fathom deep, and there terminate.

Digging the Ore, ib. p. 2101.

2. When we have found the *Load*, the laſt *Eſſay Hatch* is then called a *Tin-Shaft*, or *Tin Hatch*, which we ſink down about a *Fathom*, and then leave a little long ſquare Place, termed a *Shamble*, and ſo continue ſinking from *Caſt* to *Caſt*, i. e. as high as a Man can conveniently throw up the *Ore* with a *ſhovel*, till we find either the Load to grow ſmall, or degenerate into ſome ſort of *Weed*, which are divers; as *Mundick*, or *Maxy* corrupted from *Marchaſite*, *White*, *Yellow*, and *Green*; *Daze*, which is a kind of Glittering

Stone enduring the Fire, of different Colours, *White*, *Black*, and *Yellow*, *Iron-mould*, *Black* and *Ruſty*; *Caul*, Red, (differing both from *Mundick* and *Sparr*, enduring the Fire) which *Marcaſite* will not; *Gliſter*, Blood-red and Black.

2. We then begin to make a *Drift* 3 Foot wide, and 7 Foot high: And if the Load be not broad enough of it ſelf, as ſome are ſcarce ½ a *Foot*, then we uſually break down the *Deads*, or that part of the Shelf which contains no *Metal*, but encloſeth the Load, as a Wall, between two Rocks, and then we begin to rip the Load it ſelf.

3. The *Inſtruments* we make uſe of, are 1. A *Beele*, or *Corniſh Tubber*, *i. e.* double Points, of 8 Pound or 10 Pound weight, ſharped at both Ends, well ſteeled and holed in the middle; it may laſt in a hard Country ½ a Year, but new pointed every Fortnight at leaſt. 2. A *Sledge*, flat headed from 10 Pound to 20 Pound weight, 'twill laſt about 7 Years, new ordered once a Quarter. 3 *Gadds* or *Wedges* of 2 Pound weight, 4 ſquare, well ſteeled at the Point; they will laſt a Week; 2 or 3 Days, then ſharpned. 4. Ladders, 5. Wheel-Barrows, to carry the *Deads* and *Ore* out of the Drifts or *Adits*, to the Shambles.

4. There are two Shovel-men and 3 *Beele-men*, which are as many as one Drift can contain, without being an Hindrance to each other. The *Beele-men* rip the *Deads* and *Ore*, the *Shovel-men* carry it off, and land it, by caſting it up with Shovels from one Shamble to another, unleſs it be where we have a Winder with 2 Keebles, or Buckets, one of which comes up as the other goes down.

5. It is generally obſerved, that moſt of our *Tin Loads* run from *Weſt* to *Eaſt*, and then they conſtantly dip towards the *North*, ſometime they underlie, that is, ſlope down towards the *North*, 3 Foot in 8 perpendicular: Yet in the higher Mountains of *Dartmoor* there are ſome conſiderable Loads, which run North and South, theſe underlie towards the Eaſt.

6. Four or 5 Loads may run parallel to each other in the ſame Hill, and yet, which is rare, meet altogether in one Hatch, as it were in a Knot, which well tins the Place, and ſo ſeparate again, and keep their former Diſtances. Such a Knot hath been obſerved and wrought on *Hingſton*, a known mineral Down or Common, in *Cornwal*.

7. The Breadth of Maſter Loads may generally be from 3 to 7 Foot, ſeldom larger, unleſs where ſeveral Loads may chance to make a Knot, or ſend forth Strings or Veins. Neither retain they their uſual Breadth in all parts; for they may be 6 Foot at one place, and not 2 at another, nay, ſometimes ſcarce half an Inch over; but that is to be underſtood of Strings, and the narroweſt Places of the concomitant Loads.

8. The Load is uſually in a hard rocky Country, made up of Metal, Spars, and other Weeds, as it were all along a continued Rock: But it hath many Veins and Joints, as we ſpeak, but in ſome ſofter Countries, the Tin may lie in a ſofter Conſiſtence, as that of Clay in a Manner petrefy'd.

9. In moſt Places we meet with Water at ſome Feet deep from the loady Surface, in other ſome not at many Fathom deep. It runs continually thro'

the Heart of the *Load*. When it begins to trouble us, we begin at the Foot of the Hill a drift, or *Adit*, ſcarce half ſo big as that of the Load, and work it on a Level, till we come up to the Load. But if we have not this Conveniency of an *Adit*, or if we paſs that Level, we are forced to draw it with *Winders* and *Keebles*, or with *Pumps*. Some, but very few Works may be dry.

10. We obſerve, that if we have Water, we never want Air ſufficient for Reſpiration, and our Candles to burn in; yet ſometimes in a ſoft clayie Country, our Air is ſo much condenſed, that it becomes in a Manner a Damp and requires an Air ſharp for Vent; which Damps are ſometimes enlarged by working of the *Mundick* with the *Ore*.

11. If the Country be not ſtrong enough, we underprop our Drifts with *Stemples* and *Wall-plates*, placed much like a Carpenter's ſquare, on the one ſide, and over Head.

12. To know which Way the *Load* enclines, or to bring an *Adit*, or to ſink an *Air-ſhaft* to the deſired Place, the uſe of the *Dial* is needful, which we term *Plumming* and *Dialling*, and is thus performed. A skilful Perſon firſt faſtens the End of a long Line at a known Place, and then exactly obſerves the Point at which the Needle of his *Dial*, or *Compaſs* reſts; and at the next Flexure he makes a Mark on the Line, and again notes the *Point* at which the *Needle* ſtands at this ſecond *Station*; and ſo proceeds from turning to turning, ſtill marking the *Points*, and his Line, till he comes to the intended Place. He then repeats above-ground what he had done below, and his *Dial* and *Line* leads him, till he come exactly over the Place where he ended in the *Mine*.

Dreſſing of the Tin.

9. When the *Ore* is landed, and the greater Stones broken at the top of the *Mine* by the *Shovel-men*, 'tis brought on *Horſes* to the *ſtamping* or *knocking Mills*, and unloaded at the Head of the *Paſs*, (*i. e.* 2 or 3 Bottom Boards with two ſide boards ſloping-wiſe) in which the *Ore* ſlides down into the Coffer: But that it may not tumble down all at once, there is placed a *Hatch* nigh the lower End of the *Paſs* (*i. e.* a thwart Board to keep up the *Ore*) beneath that comes in the *Cock-water* in a Trough cut in a long Pole, which with the *Ore*, falls down into the Coffer, *i. e.* a long ſquare Box of the firmeſt Timber, 3 foot long, and 1½ foot over, wherein the 3 uſual *Lifters*, placed between 2 ſtrong broad *Lones*, having 2 *Braces*, or thwart pieces, on each ſide to keep them ſteady as a Frame, with *Stamper-heads* weighing about 30 or 40 Pound a piece, of Iron, which ſerve to break the Ore in the ſaid Coffer. Theſe *Lifters* about 8 Foot long, and ½ a foot ſquare, of *Heart-Oak*, and having as many *In-timbers*, or *Guiders*, between them, are lifted up in Order by double the Number of *Tappels*, faſtened to as many Arms paſſing diametrically thro' a great Beam, turned by an overſhot *Water-wheel*, on 2 *Boulſters*, which exactly, but eaſily, meet with the *Tongues* ſo placed in the *Lifters*, as that they quickly ſlide from each other, ſuffering the *Lifters* to fall with great force on the *Ore*, thereby breaking it into ſmall *Sand*, which is waſhed out by the *Cock-water*, thro a *braſs Grate*, holed very thick, and placed within 2 *Iron Bars* at one End of the Coffer into the *Launder*, *i. e.* a

Trench cut out in the *Floor*, 8 foot long, and 10 foot over, ſtopt at the other end with a Turf, ſo that the Water runs away, and the *Ore* ſinks to the Bottom; which when full, is taken up and emptied with a Shovel.

2. The *Stamping-mill* is thus contrived to go 2 Hours or more, after we give over our Attendance on it. We have a *Tiller*, *i. e.* a long Pole, faſtened without at one End to the *Slew* or *Ponder*, *i. e.* that looſe and laſt part of the Trough that conveys the Stream to the *Mill-wheel*, and at the lower end is tied a ſhort Rope with a tranſverſe Stick at the End of it, curiouſly, but trap-ways hitcht at both ends under 2 little Pins, faſtned in the *Lanes* for that purpoſe; there's another Pin ſet in one of the *Lifters*, at ſuch an exact height, as that if there be no *Ore* in the Coffer to keep that *Lifter* high enough, the purpoſed Pin in deſcending, knocks out the Water, carrying it quite over the Mill-wheel; ſo that when the Coffer is emptied, the Mill reſts of its own Accord.

3. The *Launder* is divided into 3 parts, *i. e.* the *Forehead*, the *Middle*, and the *Tail*. That *Ore* which lies in the *Forehead*, *i. e.* within $1\frac{1}{2}$ foot of the Grate, is the beſt *Tin*, and is taken up in a Heap apart. The *Middle* and *Tails* in another, accounted the Worſt.

4. The latter *Heap* is thrown out by the *trambling Buddle*, *i. e.* a long ſquare Tye of Boards, or Slate, about 4 Foot deep, 6 long, and 3 over; wherein ſtands a Man bare-footed with a *Trambling Shovel* in his Hand to caſt up the *Ore*, about an Inch thick, on a long ſquare Board juſt before him, as high as his Middle, which is termed the *Buddle-head*, who dexterouſly with the one Edge of his Shovel, cuts and divides it longways in reſpect of himſelf, about half an Inch aſunder; in which little Cuts the Water coming gently from the Edge of an upper plain Board, carries away the Filth and lighter part of the prepared *Ore* firſt, and then the *Tin* immediately after; All falling down into the Buddle, where with his bare Foot he ſtrokes and ſmooth it tranſverſly to make the Surface the plainer, that the Water and other heterogeneous Matter, may without Let paſs away the quicker.

5. When this *Buddle* grows full, we take it up, here diſtinguiſhing again the *Fore-head* from the *Middle* and *Tails*; which are trambled over again: But the *Forehead* of this with the *Forehead* of the *Launder*, are trambled in a ſecond *Buddle*, but not different from the firſt, in like manner. The Forehead of this being likewiſe ſeparated from the two other parts, is carried to a third, both *Drawing Buddle*, whoſe difference from the reſt is only this, that it hath no Tye, but only a plain ſloaping Board, whereon 'tis once more waſhed with the *Trambling Shovel*, and ſo it new names the *Ore*, *Black Tin*, *i. e.* ſuch as is compleatly ready for the *Blowing-Houſe*.

6. We have another more curious way termed *Sizing*, that is, inſtead of a *drawing Buddle*, we have an Hair Sieve, thro' which we ſift, caſting back the Remainder in the Sieve into the *Tails*, and then new tramble that *Ore*. After the ſecond Trambling, we take that Forehead in the ſecond Buddle, and dilve it, *i. e.* putting it into a canvas Sieve, in a large Tub of Water luſtily ſhake it, ſo that the Filth gets over the Rim of the Sieve, leaving the

Black-Tin behind, which is put into *Hogſheads*, covered and lockt, till the next *Blowing*.

7. The *Tails* of both *Buddles*, after 2 or 3 tramblings, are caſt out into the firſt *Strake*, or *Tye*, which is a Pit purpoſely made to receive them; and what over-ſmall *Tin* elſe may waſh away in trambling. There are commonly 3 or 4 of them ſucceſſively, which contain 2 ſorts of *Tin*; the one which is too ſmall, the other 2 great. The latter is new Ground in a *Craze Mill*, in all reſpects like a *Greiſt-mill*, with 2 Stones, the upper and the nether, and after that trambled in Order; the former, by reaſon of its exceeding ſmallneſs, is dreſſed on a *Reck*, provided for that purpoſe, that is a Frame made of Boards about 3 Foot and a half broad, and 6 long, which turns upon 2 iron Pegs faſtened in both Ends, and the whole placed on two Poſts, ſo that it hangs in an *Æquilibrium*, and may, like a Cradle, be eaſily removed either way, with the Shovel and Water.

Blowing of Tin.

4. When we perceive much *Mundick* in our *Tin*, which makes it britly hard, we are neceſſitated to burn away the *Weed* in a *Tin Kiln*; this *Kiln* is four-ſquare, and at the top a large Moor-ſtone, about 6 foot long, and 4 broad; in the middle thereof is an Hole made about half a foot Diameter. About a foot beneath this *Stone*, is placed another not ſo long by half a foot, becauſe it muſt not reach the innermoſt or back part of the Wall, which is the open Place thro' which the *Flame* aſcends from a leſſer Place below that, where a very ſtrong Fire of *Furze* is conſtantly made. The fore part is like a common Oven; but near the back on the one ſide, there is another little ſquare Hole. When the *Kiln* is throughly heated, the *Black Tin* that is to be burnt, is laid on the Top-ſtone, and as much of it is caſt down at the ſquare hole upon the 2*d.* or *bottom ſtone*, as will cover it all over about 3 or 4 Inches thick; then the Hole at the top is immediately covered with green Turfs, that the Flame may reverberate the ſtronger: And a *Rake-man* with an iron *Coal-Rake*, conſtantly ſpreads and moves the *Tin*, that all parts of the *Mundick* may get uppermoſt of the *Tin*, and ſo be burned away; which we certainly know by this, that then the *Flame* will become yellow, (as uſual) and the *Stench* leſſened; for whilſt the *Mundick* behind, burns, the *Flame* is exceeding blue; then with the *Rake* he thruſts it down, at the open Place into the open Fire, and receives a new Supply of *Tin* from above. Now when the Place beneath, where the *Fire* is made, grows full of *Tin*, *Coals* and *Aſhes*, with his *Rake* he draws it forth with the Coals, at the little ſquare Hole on one ſide, near the Back, where the *Ore* (fiery hot and red) lies in the open Air to cool, which will ſcarce be in 3 Days, becauſe of the *Coals* that lie hid in it: But in caſe we cannot ſtay ſo long, then we quench it with Water, and it is like *Mortar*. Albeit we let it cool of it ſelf, or with Water, we muſt new tramble it, or waſh it, as before, before we put it into the Furnace, which is no other than an *Alman Furnace*. *Moor-Tin*, *i. e.* ſuch as is digged up in the *Moors*, we find *Runs* or *Melts*, beſt with *Moor-Cool*, *chark't*: But our *Tin* which lies in the Country, runs beſt with an equal Proportion of *Charcoal* and *Peate*, *i. e. Moor-coals*, for the firſt Running; but when we come to remelt our *Slags*, then we uſe *Charcoal*. When all is mel-

ted down and remelted, there ſometimes remains a different *Slag* in the Bottom of the *Float*, which we term *Mount Egg*, and that is moſt an iron Body, tho' of a Tin Colour; as I accidentally aſſured my ſelf, by applying one of the Poles of a Loadſtone to it, and quickly attracted it, yet not ſuch a Quantity, by far, as that of Iron.

By Dr. Chr. Merret, n. 138. p. 949. 2 The Stones from which *Tin* is wrought, are moſt uſually found betwixt two *Walls* of *Rocks*, which are commonly of an iron Colour, of little or no Affinity with the *Tin*, in a Vein or Lead (as the *Miners* call it) betwixt 4 and 18 Inches broad, or thereabout. Sometimes there is a rich and fat Metal, ſometimes hungry and ſtarved; ſometimes nothing but a droſſy Subſtance, not purely Earth, nor Stone, nor Metal; but a little reſembling the rejected Cynders of a *Smith*'s Forge, appearing ſometimes of a more flouriſhing Colour tending to *Carnation*, and ſometimes more umbratile; and where this is found, the *Miners* judge the Metal to be ripe. The Pits are ſometimes above 60 Fathoms deep.

The Load being very rich and good, above that is 10 *Fathoms* from the *Graſs* or thereabouts. And below that, there's a ſtrange Cavity, or empty Place, wherein is nothing but Air for many *Fathoms* deep, as the *Miners* have tried with long Poles and Pikes. This *Cavity* lies between hard ſtony *Walls*, diſtant one from another about 6 or 9 Inches. The *Labourers* tell Stories of Sprights or ſmall People, as they call them; and that when the Damp ariſeth, from the ſubterranean Vaults, they hear ſtrange Noiſes, horrid Knockings, and fearful Hammerings. Theſe Damps render many lame, and kill others outright, without any viſible Hurt upon them.

Though *Tin*, for the moſt part, be made from the *Stones* in which it is incorporated, yet ſometimes it is, as it were, mixed with a ſmall gravelly Earth, ſometimes white, but for the moſt part red. From this Earth it is eaſily ſeparated with bare Waſhing: This gravelly *Tin* is called *Pryan-Tin*; and is ſcarce half the Goodneſs of the other.

The *Mundick Ore* is eaſily diſcover'd by its glittering, yet ſad Brownneſs wherewith it will ſoon colour your Fingers. This is ſaid to nouriſh the *Tin*, and yet they ſay, where much *Mundick* is found, there's little or no *Tin*. Certain it is, if there be any *Mundick* left in *melting* the *Tin*, it makes it thick and *cruddy*, that is not ſo ductile as otherwiſe; and therefore uſually draws down the *Metal* to an Abatement, from 5 *ſhillings* to 8 *ſhillings* in the *Hundred weight*. This *Mundick* ſeems to be a Kind of *Sulphur*. Fire only ſeparates it from the *Tin*, and evaporates it into *Smoke*. Little Spriggs or Boughs being ſet in the *Chimney*, the Smoke gathereth upon them, into a Subſtance which they call *Poyſon*, and think it a Kind of *Arſenick*, which being put into Water, eaſily diſſolves and produces very good *Vitriol*. The Water wherein it is diſſolved, ſoon changeth ſmall *iron Rods* put into it; and they ſay, that in a very little Time, it will aſſimilate the Rods into its own Nature. 'Tis generally concluded, that *Fiſh* will die in thoſe *Waters* whereinto *Mundick* is caſt and they commonly impute the Death of ſome of their Neighbours to their drinking of *Mundick* Waters. When they burn it, to *ſeparate* it from *Tin*, there proceeds from it a Stench very Loathſome and Dangerous.

There alſo Occurrs a ſort of *Spar*, of a Shiny Whitiſh Subſtance which caſteth a White Froth upon the Water in waſhing it. When firſt taken out of the Earth 'tis ſoft and fattiſh; but ſoon after it grows ſomewhat hard. It it ſeldom found growing, but only Sticking to the Metal. The Miners call it *White Spar*; and ſome of them think it is the Mother or Nouriſher of the Metal. But 'tis certain that Spar is often met with in Mooriſh Grounds, where they never hope to find any Ore: Yet no *Tin* Mines are without it.

The *Corniſh Diamonds*, ſo called, lie intermixed with the *Ore*, and ſometimes on Heaps. They are hard enough to cut Glaſs, and ſome of them are of a *Tranſparent Red*, and have the Luſtre of a deep Ruby. Theſe Diamonds ſeem to me to be but a finer, purer and harder ſort of *Spar*.

Godolphin Ball is the moſt famous of all the Balls or Mines in *Cornwall*, for the Quantity of Metal. Though ſome of late Years pretend another Mine (which ſome call the *Silver-Mine*, others the *Lead-Mine*) more rich than that. I have ſeen an Eſſay made of ſome of that Ore, as 'twas ſaid, brought from thence; whereof 10 Pound weight yielded 2¼ Ounces of Fine Silver.

The beſt Ore is that which is in Sparks; and next to this, that which hath bright *Spar* in it.

When the Ore has paſſed the *Stamping-Mill*, and is well waſhed and ſeparated from the parts not *Metalline* (which they call the Cauſalty) they dry it in a Furnace on Iron Plates, and then Grind it very fine in a Crazing-mill. After this they Re-waſh it, then dry it a little, and carry it laſt of all thus fitted to the *Furnace*, called by them a Blowing-Houſe, and there melt and caſt it.

There ſwims on the Metal, when it runs out of the *Furnace*, a Scum, which they call *Droſs*; much like to *Slag* or *Droſs* of *Iron*; which being melted down with freſh Ore, runneth into Metal.

The Cauſalty they throw in Heaps upon Banks, which in 6 or 7 Years they fetch over again: But they obſerve that in leſs time it will not afford Metal worth the Pains; and at the preſent none at all.

Lead Mines *in* Somerſetſhire; *By* Mr. Joſ. Glanvil; n. 28. p. 525

CIV. 1. I am well inform'd, that all *Mendip* in *Somerſetſhire* is Mountanous: Yet the Hills not Equal in Height. It is barren and Cold, and Rocky in ſome places. The Ridges thereof run confuſedly, but moſt Eaſt and Weſt, and not in any Parallel one with another. Upon the Surface thereof, it is *Heathy*, *Ferny* and *Furzy*; and the Cattle it feeds, for the moſt part, are Sheep, which go there all the Year; and young Beaſts, Horſes and Colts, at Spring and Fall. The Sheep are not Fair but Big-bellied, and will grow to no Bigneſs, after they have been there Fed; but will grow Fat, if they are removed into better Soil; and ſo their Beaſts and Horſes.

The Inhabitants live Wealthy, ſaving ſuch as are Employed about melting of the Lead at the Mines; who, if they work in the Smoak, are ſubject to a Diſeaſe, that will kill them, and the Cattle likewiſe that feed thereabout. The Smoak that reſts upon the Ground, will bane them: And therefore

fore the Inhabitants have Keepers to keep them from it, for fear of the Infection. At the Foot of the Hills there are many Springs which are very wholſome; and produce Rivers, after they have run to ſome diſtance from thence. The Air is moiſt, cold, foggy, thick and heavy.

The *Soil* is Red and ſtony; and the Stones are either of the Nature of *Fire ſtones* or *Lime-ſtones*, but no way Clayie, Marly, or Chalky. The *Trees* have their tops Burnt, and their Leaves and out-ſides Diſcoloured, and ſcorched with the *Wind*, and grow to no Bigneſs. The *Stones* that are waſht by the Brooks and Springs, are of a Reddiſh Colour, and Ponderous. Snow, Froſt, and Dew, ſtay upon *Mendip* longer, than upon any of the Neighbouring Grounds. Thunder and Lightning, Storms, Nocturnal Lights, and Fiery Meteors, are more frequent than Ordinary.

When they have got the Ore they Beat it ſmall, then waſh it clean in a running Stream; then ſift it in Iron-Rudders, then they make of Clay, or Fire-ſtone, an Hearth, or Furnace which they ſet in the Ground, and upon it build their Fire, which is lighted with Charcoal, and continued with young *Oaken Gadds*, blown with Bellows by Men's treading on them: And after the Fire is lighted, and the Fire place Hot, they throw their Lead-Ore upon the *Wood*, which Melts down into the Furnace; and then with an Iron-Ladle they take it out, and upon *Sand* Caſt it into what Form they pleaſe.

A further account by Mr Glanvil. n.39 p.767.

2. I am farther informed, by experienced Mine-Men, that they have ſometimes known the Vein to run up into the Roots of Trees, and yet they have obſerved no difference at the top, with reſpect to the other *Trees* there, into whoſe Roots no ſuch Veins run. The *Snow* and *Froſt*, near the Grooves melt quickly, but continue long at further diſtance. Sometimes when a Mine hath been very near the *Surface*, the Graſs hath been Yellow and diſcoloured. They have no value for the *Virgula Divinatoria*; yet they ſay when the Mine is open, they may Gueſs by it, how far the Vein Leads. *White*, *Yellow* and *Mixt Earth* are *Leaders* to the Country (as they call it;) Changeable Colours always incourage their Hopes. For Stones, they are ſometimes 12 Fathom deep, before they meet any: Other while, when a Stony-Reak at Top, they meet Ore juſt under the Sward [Superficies] of the Graſs, which *Ore* hath gone down about 40 Fathom. A Black-Stone is of bad Signification, and Leads to a *Jam* [a black thick Stone, that hinders their Work:] A Grey Clear Dry one, they account beſt. They ſeldom encounter Damps. If in ſinking they come to Wet Mooriſh Earth, they expect a *Jam*, and to be cloſed up with Rocks. The Nearneſs they Gueſs by ſhort brittle Clay; for the Tough is not Leading.

The *Ore* ſometimes is *Shole*, and again it is 14 or 20 Fathom, more or leſs before they hit it. They follow a Vein inclining to ſome depth, when it runs away in Flat Binns.

When the Stones part it then they find a Vein again. Their Draughts are 14 or 16 Fathom, till they come to a Stone, where they caſt aſide a Draught call'd a cut. Then they ſink Plum again 4 or 5. Cuts, one under another. They find *Ore* at 50 Fathom. Their beſt Reaks are North and

South; Eaſt and Weſt are good, though not ſo deep. The Groove is 4 Foot long, 2½ Foot broad, till they meet a Stone, when they carry it as they can. The *Groove* is ſupported by Timber: A piece of an Arm's bigneſs will ſupport 10 Tun of Earth. It laſts long; that which was put in beyond the Memory of Man (nay which by the difference in the manner of Working their Mines, they know to have lain above 200 Years) will ſerve in New-Works. It is Tough and Black, and being expoſed to the Sun and Wind for 2 or 3 Days, will ſcarce yield to an Ax.

For the ſupply of Air they have Boxes of Elm exactly cloſed, of about 6 Inches in the cleer, by which they carry it down above 20 Fathom. But when they come at *Ore* and need an *Air-ſhaft*, they ſink it 4 or 5 Fathom diſtant, of the ſame Faſhion with a *Groove*, to draw as well *Ore*, as *Air*.

They make uſe of Leathern Bags, of 8 or 9 Gallons a piece drawn up by Ropes, to Free the Water. If they find a *Swallet*, they drive an *Adit*, upon a Level, till 'tis dry.

If they cannot cut the Rock, they uſe Fire to Aneale it, laying on Wood and Coal, and the Fire ſo contrived, that they leave the Mine before Operation begins, and find it dangerous to enter again, before it be quite clear'd of the *Smoak*; which hath killed ſome.

Their *Beetles*, *Axes*, *Wedges*, &c. unleſs ſo hardned as to make a deep Impreſſion upon the Head of an Anvil, are not fit for their uſe; and yet they ſometimes break them in an Hour; others laſt 3 or 4 Days, as it happens. They work cloathed in Frocks and Waſt-Coaſts, by Candle-Light of Tallow, 14 or 15 to the Pound, each whereof laſts 3 Hours, if they have Air enough; which if they want to keep in the Candles, the Workmen cannot ſtay there. A Vein being loſt, they drive 2 or 3 *Fathoms* in the Breaſt, as the nature of the Earth directs them. They convey out their Materials in Elm-Buckets drawn by Ropes: The Buckets hold about a Gallon. Their Ladders are of Ropes.

The *Ore* runs ſometimes in a Vein, ſometimes diſperſed in Banks. It lies many times between Rocks: Some of it is hard, ſome milder. Many times they have Branched *Ore* in the *Spar*. About the *Ore* there is *Spar* and *Chalk*, and another ſubſtance, which they call the *Crootes*, which is a Mealy, White Stone, marted with *Ore*, and Soft. The *Spar* is White, Tranſparent and britle like Glaſs. The Chalk White and Heavy; heavier than any *Stone*. The Vein lies between the *Coats*, and is of different Breadths. It breaks off ſometimes abruptly in an Earth, they call a *Deading Bed*, and after a Fathom or two may come again, keeping the ſame Point. It *Terminates* ſometimes in a Dead Earth, Clayie, without *Croot* or *Spar*; ſometimes in a Rock call'd a *Fore Stone*.

The cleareſt and heavieſt *Ore* is the beſt; 36 hundred of Ore may yield a Tun of Lead.

The Hearth for Melting the Ore is about 5 Foot high, ſet upon Timber, to be turned as a Wind-Mill, to avoid the Inconveniences of *Smoak* upon a ſhifting Wind. It contains half a Buſhel of Ore and Coal. There is a ſink upon the ſides of the Hearth, into which the Lead runs, that holds about 1½ Hundred. They have a Bar to ſtir the Fire; a ſhovel to throw it up; and a Ladle heated red hot to caſt out the Melted Metal. Once Melting is enough: and the beſt (which is diſtinguiſh'd by its Weight) Melts firſt.

There is a Flight in the *Smoak*, which falling upon the Graſs, Poyſons thoſe Cattel that Eat of it. They find the Taſte of it upon their Lips to be *Sweet* and when the *Smoak* chances to fly in their Faces. Brought home and laid in their Houſes, it kills Rats and Mice. If this *Flight* mix with the Water, in which the *Ore* is waſh'd, and be carried away into a *Stream*, it hath Poiſoned ſuch Cattel as have drunk of it after a Current of three Miles. What of this *Flight* falls upon the *Sand*, they gather up to Melt upon a Flag Hearth, and make *Shot* and *Sheet Lead* of it.

They ſometimes find *Slags*, 3, 4, or 5 foot under Ground; but ſuch as they judge were caſt aſide heretofore.

They have ſometimes heard Knockings beyond their own Works, which when followed by them, have afforded Plenty of *Ore*. And one *King* of *Wells* about 2 Years ſince found in his *Groove* a Piece of *Ore*, in which they fancied the ſhape of a Man, Eyes, Arms, Legs, full Breaſt, *&c.* The whole was about 4 Inches in length; the Mine proved rich.

In Germany; By [illegible] n. 1. p. 10.

3. There is a Peculiar Lead *Ore* found in the *Upper Palatinate*, at a place call'd *Freyung*; and there are two ſorts of it, whereof one is a kind *Cryſtalline Stone*, and almoſt all good Lead; the other not ſo rich, and more Farinaceous. The Mines of that Place having lain long neglected, the People living thereabout take it for what their Fathers had thrown away, and had lain long in the open Air. It is of ſingular uſe for Eſſays upon the *Coppel*, ſeeing that there is not any other Metal mixed with it.

The Poyſonous *Quality* of Lead Ore; By Mr. J. Beaumont. *Ph. Col.* n. 2. p. 6.

CV. Thoſe who live near where *Lead-Ore* is waſht, cannot keep either Dog or Cat, or any ſort of Fowl, but they all die in a ſhort time; and I have known of a little Houſe wherein Lead Ore was kept ſome time, though afterward made very clean and well bedded with *Fern*, yet when *Calves* were put into it, they all died ſhortly after; and Children ſometimes, in theſe Houſes, have died ſuddenly. If any ſort of Cattle Eat often of that Graſs, on which the Steam, which riſes from the Smelting of Lead, falls, they all die in a while after.

The Way of Making of Ceruſs; By Sir Philiberto Verna n. 127. p. 95.

CVI. Pigs of clean and ſoft Lead are caſt into thin Plates, a Yard long, and 6 Inches, broad These are rolled round, ſo as the Surfaces no where meet to touch: For where they do no *Ceruſs* grows. Each of theſe is put into a Pot, juſt capable to hold one, upheld by a little Bar from the bottom, that it come not to touch the *Vinegar*, which is put into each Pot, to effect the Converſion. Twenty of theſe abreaſt, are put into a ſquare Bed of New Horſe-Dung; and each Pot is covered with a Plate of Lead; and laſtly, all with Boards, as cloſe as conveniently can be. This repeated 4 times, makes one heap, ſo called, containing 1600 Pots.

After 3 Weeks the Pots are taken up, the Plates unrolled, laid upon a Board, and beaten with *Battle Doors* till all the *Flakes* come off; which, if good, prove thick, hard and weighty. Theſe *Flakes* are ground with Water, between Mill-ſtones, to almoſt an Impalpable Fineneſs. After which it is moulded into ſmaller Parcels, and expoſed to the Sun to dry, till it be hard, and ſo fit for uſe.

'Tis obſerved, that ſome Pots will yield thick and good *Flakes*, whilſt others, alike ordered and ſet by them, without any poſſible Diſtinction of Advantage, yield few and ſmall, or none at all. Sometimes the Poles are taken up all dry, and ſo ſometimes prove beſt; ſometimes again they are taken up wet. The Plates that cover the Pots yield better and thicker *Flakes*, than do the Rolls within. And the outſides, next to the Planks, bigger and better than the inſides, next to the Rolls, and the Spirits that firſt ariſe out of the *Vinegar*.

The Accidents which happen to the Workmen, are 1. Immediate *Pain* in the *Stomach*, with exceeding *Contorſions* in the Guts, and *Coſtiveneſs* that yields not to *Catharticks*, hardly to often repeated *Clyſters*: Beſt to *Lenitives*, *Oyl* of *Olives*, or ſtrong new *Wort*. It brings them alſo to *Acute Fevers*, and great *Aſthma's* or *Shortneſs* of *Breath*. And theſe we find effected principally by the *Mineral Steams* in the caſting of the Plates of Lead, and by the Duſt of the *Flakes*. Alſo by the Steams coming from out of the Heaps, when the Pots are taking up.

Next a *Vertigo*, or *Dizzineſs* in the Head, with continual great Pain in the *Brows*, *Blindneſs*, *Stupidity*, and *Paralytick Affections*; *loſs of Appetite*, *Sickneſs*, and frequent *Vomitings*, generally of ſincere *Phlegm*, ſometimes mixed with *Choler*, to the extreameſt weakneſs of the Body; and theſe chiefly in them that have the charge of Grinding, and over the drying Place.

The Quick-ſilver Mines in Friuli; By *Dr.* Wal. Pope. n. 2. p. 21.

CVII. 1. The Mines of *Mercury* in *Friuli*, a Territory belonging to the *Venetians*, are about a Days Journey and an half diſtant from *Goritia* Northwards, at a place call'd *Idria*, ſituated on a Valley of the *Julian Alps*. They have been, as I am informed, theſe 160 Years in the Poſſeſſion of the Emperor, and all the Inhabitants ſpeak the *Sclavonian* Tongue. In going thither we travelled ſeveral Hours in the beſt *Woods* I ever ſaw; being very full of *Firrs*, *Oaks*, and *Beeches* of an Extraordinary thickneſs, ſtraitneſs, and height. The Town is built as uſually Towns in the *Alps* are, all of *Wood*, the Church only excepted, and another Houſe wherein the Overſeer liveth. When I was there in *Auguſt* 1664, the Valley and the Mountains too, out of which the *Mercury* was dug, were of as pleaſant a *verdure*, as if it had been in the midſt of *Spring*, which they there attribute to the Moiſtneſs of the *Mercury*. That Mine which we went into, the beſt and greateſt of them all, was dedicated to *St. Barbara*, as the other Mines are to other *Saints*. The uſual way down to it is at the beginning not Difficult, the Deſcent not being much, the greateſt Trouble is, that in ſeveral Places you cannot ſtand upright: but this holds not long, before you come to Deſcend in earneſt by Perpendicular Ladders, yet when produced, they do not ſeem to make one Ladder, but ſeveral Parallel ones. At the End of each Ladder, there are Boards acroſs where we may Breath a little. All the way down, and the bottom, where there are ſeveral Lanes cut out in the Mountain, is lined and propt with great pieces of *Firr-Trees* as thick as they can be ſet. They dig the *Mineral* with Pick-Axes, following the Veins: 'Tis for the moſt part hard as a Stone, but more Weighty; of a *Liver-Colour*, or that of *Crocus Metallorum*. There is alſo ſome ſoft Earth in which you plainly ſee the *Mercury* in little Particles. Beſides this, there are oftentimes found in the Mines round *Stone's* like Flints, of ſeveral bigneſſes, very like thoſe Globes of Hair which I have ſeen in *England*, taken out of Ox's Bellies. There are alſo ſeveral *Marcaſites* and *Stones*, which ſeem to have Specks of Gold in them; but upon Tryal, they ſay, they find none in them. Theſe round *Stones* are ſome of them very Ponderous, and well Impregnated with *Mercury*; others Light, having little or none in them.

The manner of getting the *Mercury* is this: They take of the Earth, brought up in Buckets, and put it into a Sieve, whoſe bottom is made of Wires at ſo great a diſtance, that you may put your Finger between them; 'tis carried to a Stream of running Water, and waſhed as long as any thing will paſs through the Sieve. That Earth which paſſeth not, is laid aſide upon an heap; that which paſſeth, is reſerved in a Hole, and is taken up again, and put into a ſecond *Sieve*; and ſo on to about 10 or 12 *Sieves* proportionably leſs. It often happens in the Firſt Hole, that there is *Mercury* at the bottom; but towards the farther End, where the Intervals of the Wire are leſs, its found in very great Proportion. The waſte Water is ſo much Impregnated with *Mercury*, that it cureth *Itches* and other *ſordid Ulcers*. The Earth laid aſide, is Pounded, and the ſame Operation repeated. The fine ſmall Earth that remains after this, and out of which they can waſh no more *Mercury*, is put into Iron *Retorts*, and the Fire forces the *Mercury* into the *Receivers:* The Officer unluted ſeveral of them; and I obſerved in all that he firſt poured out Perfect *Mercury*, and after that came a Black Duſt, which being wetted with Water, diſcovered it ſelf to be *Mercury* as the other was. They take the *Caput Mortuum* and Pound it, and renew the Operation. There are 16 Furnaces for this uſe, each of them carrying 24 *Retorts*; in all 384 *Retorts*.

All the *Mercury* got without the uſe of Fire, whether by Waſhing or found in the Mines (for in the digging ſome, the Particles get together, ſo that in ſome places you might take up two or three Spoonfuls of pure *Mercury*) is called by them Virgin Mercury, and eſteemed above the reſt. The Officer told me, that making an *Amalgama* of *Gold* and *Virgin* Mercury, and putting it to the Fire, that Mercury would carry away all the Gold with it, which Common Mercury would not do.

The Engines for drawing the Water, are all moved by Water, brought thither in no Chargeable *Aqueduct* from a Mountain three Miles diſtant. The Water Pumpt from the bottom of the Mine, by 52 Pumps, 26 on a ſide, is contrived to move other *Wheels*, for ſeveral other purpoſes.

The Labourers (being 280 always employed) work for a *Julio* a Day; which is not above 6 or 7 Pence, and endure not long: For although none ſtay under ground above 6 Hours; all of them in time (ſome later, ſome ſooner) become *Paralytick*, and die *Hectick*. We ſaw a Man who had not been in the Mines for above half a Year before, ſo full of Mercury, that putting a piece of Braſs in his Mouth, or rubbing it in his Fingers, it immediately became as White, as if he had rubbed Mercury upon it. Thoſe alſo that Work upon the back ſide of *Looking Glaſſes*, are very ſubject to the *Palſey*.

They convey their Wood thus, about four Miles from the Mines on the ſides of two Mountains, they cut down the *Trees*, and draw them into the Interjacent Valley: higher up in the ſame Valley they make a *Lock* or *Dam*; when the Water is ready to run over it, they open the *Flood-Gates*, and the Water carries all the *Trees* impetuouſly to *Idria*, where the Bridge is built very ſtrong, and at very Oblique Angles to the ſtream, on purpoſe to ſtop them, and throw them on ſhore near the Mines.

Thoſe Mines heretofore coſt the Emperor 70000 or 80000 *Florens* yearly; but now they coſt him not above 28000. They produced

	Anno 1661.	*Anno* 1662.	*Anno* 1663.
	ll.	*ll.*	*ll.*
Ordinary Mercury.	198481	225066	244119
Virgin Mercury.	6194	9612	11862
in all	204675	234678	255981

2. The Town of *Idria* in the County of *Goritia* and Province of *Friuli*, is ſeated low, and encompaſſed with Hills on all ſides. A River of the ſame Name runs by it, and proves ſufficient upon Plentiful Rains to convey down the *Firr-Trees* and other Wood required in the ſervice of the Mines: And to this End there is an handſome Work of *Piles* made ſloaping athwart the River (after the ſame manner as I obſerved in *Newſol* in *Upper Hungary*, croſs the River *Gran*) to ſtop the *Trees*.

By Dr. Edw. Brown. n. 54. p. 1018.

The Entrance into theſe Mines is not high, or upon an Hill, but in that Town it ſelf. The deepeſt part of the Mine from the Entrance, is between 120 and 130 Fathoms.

The *Virgin Quickſilver*, which they call *Jungfraw*, is that which diſcovers it ſelf without the help of Fire. Sometimes it is plainly ſeen in the *Ore*, or falls down in Drops, and ſometimes Streams out in good quantity; as about ſeven Years ago it ran out of the Earth at firſt in a Stream as ſmall as a *Thread*, and afterwards as big as a *Packthread*, but ceaſed in 3 or 4 Days. That alſo is accounted *Virgin Quickſilver*, which is ſeparated only by Water.

Plain *Quickſilver* they obtain by Fire out of the Ore, or out of the *Cinnaber* of Mercury, which they dig out of this Mine. The *Ore* of this Mine is of a dark Colour, mixed with Red.

The *Quickſilver* Ore of this Mine ordinarily contains half, and ſometimes $\frac{2}{3}$ of *Quickſilver.*

I went into the Mine by the Pit of St. *Agatha*, and came up again by that of St. *Barbara*, deſcending and aſcending by Ladders. I aſcended at one of 639 Staves, or 89 Fathoms. It has been wrought 200 Years, about the ſame ſpace of time with *Newſol*-Mine, but comes much ſhort in time of the Silver Mine at *Schemnitz*; and much ſhorter yet of the notable Lead Mines in *Upper Carinthia*.

In a *Laboratory*, where the Quickſilver is ſeparated by *Fire*, I ſaw an heap of 16000 *Retorts* of Iron; every one of which coſts a Crown at the beſt hand from the *Iron Furnaces* in *Carinthia*. There are 800 *Retorts*, and as many *Recipients*, employed together, in drawing over the *Quickſilver* in 16 *Furnaces*; 50 in each *Furnace*, 25 of a ſide; 12 above, and 13 below of each ſide.

June 12. 1669, when I was there, they carried out 40 *Saumes* of *Quickſilver* into Foreign Parts, each *Saume* containing 315 pound Weight, to the value of 4000 *Ducats* of Gold. Some of it is ſent as far as *Cremnitz* in *Hungary*, for the uſe of the Gold Mines: And very much carried away Southward; for they are not far from the *Sontius*, or *Lyſonzo*, a conſiderable River, which runs into the *Gulf* of *Trieſte* in the *Adriatick Sea*.

In the Caſtle, I ſaw 3000 *Saumes* of *Quickſilver* together in Barrels; the *Quickſilver* being firſt made up in double Leather: And in another Houſe as much Ore as can be diſtilled in two Years, except they have great Plenty of Rain to bring down the Wood.

The Country is well ſtored with ſtately *Firs*, *Larches*, *Pines*, *Pinaſters*, *Picea*'s, and that nobly Criſped and well grain'd kind of *Acer*, whereof *Viols* and *Violins* are made: Whereof there is alſo *Plenty* in the Country of *Saltzburg* and *Carniola*.

Travelling ſometimes in the Night, we had continually about us a great number of large *Glow-worms*, which put into Papers, gave a dim Light like Candles in Lanthorns; and the Air alſo was full of *Flaming Flies*, affording ſome delight unto us.

The way to this Place from *Croatia* I found difficult; and coming from it to *Aidoſchini* and *Croatia*, I paſſed over *Swartzenburg*, or the Black Mountain, from whence I deſcended 10 Miles in a Rocky Country, and far more *Stony* than the *Craw*, or *Campus lapidoſus*, in *Provence*.

Mercury *found in* Plants; *By* S. Manfred Septalius, n 27. p. 493

CVIII. In the Valley of *Lancy*, which runs between the Mountains of *Turin*, grows a Plant like the *Doronicum*, (ſo alſo called by the Inhabitants and *Botaniſts*;) near the Roots whereof you may find *Pure Quickſilver*, running in ſmall Grains like *Pearls*; the *Juice* of which Plant being expreſſed, and expoſed to the Air of a clear Night, there will be found as much Mercury, as there is loſt of Juice.

The Incaleſcence *of* Mercury *with* Gold; *By* B. R. n. 122. p. 515.

CIX. Though I have many things to object againſt the *Sympathy* of *Gold* with *Quickſilver*; yet perhaps there may be a *Quickſilver* more Subtle and

Ponderant than that which is common, which may enable the *Chymiſt* to argue very ſpeciouſly for it.

It is hotly diſputed among the curious in *Chymiſtry*, whether or no there be any ſuch thing as a *Mercury*, which being barely mingled with *Gold*, reduced to fine parts, will produce any ſenſible Heat. The *Affirmative* is aſſerted by ſome that pretend to the *Tranſmutation* of *Metals*, who aſcribe this Virtue to the *Mercuries*, extracted, as they ſuppoſe, from ſome compleat Metals; which are therefore in their Phraſe, ſtyl'd *Mercurii Corporum*, or the *Mercuries* of *metalline Bodies*. But the Negative is more generally maintain'd, not only by Philoſophers and Phyſicians, but the more learned *Spagyriſts* themſelves, eſpecially the *Modern*.

I the leſs wonder at this latter Opinion, becauſe having purpoſely enquired of ſeveral prying *Alchymiſts*, they have a-part ingenuouſly confeſſed to me, that they never actually ſaw any *Incaleſcent Mercury*, though they had ſometimes heard it boaſted of.

But notwithſtanding all this, having for ſeveral reaſons look'd upon *Mercury* as a Body which is not neceſſarily ſo *humogeneous* as it is ſuppos'd, the Opinion I moſt liked of was, that of a Poſſibility of an incaleſcent Mercury. For notwithſtanding the vulgarly ſuppoſed ſimilar Nature of *Quickſilver*, which I willingly confeſs to be great enough to be admirable, yet having deviſed two ways (unpractiſed that I know of by any *Chymiſt*) the one to diſcover whether a clean and carefully diſtilled Mercury might not be a compounded Body, and have in it Parts that are not mercurial; and the other out of ſuch a fine diſtilled Mercury to ſeparate Parts, and that in no deſpicable Number, that are plainly *heterogeneous*; I found upon Trial, that both the Methods I had thought on would ſucceed; which warranted me to think it poſſible, that a Mercury very fine and clean, and even purged by Sublimations and Diſtillations, may, by Art, have been made to aſſume and incorporate with it a Multitude of heterogeneous Corpuſcles, not to be diſcovered, much leſs ſeparated, (as thoſe of *Tin*, *Lead*, *&c.* may be) but by a ſkilfull Artiſt.

This was enough to ingage me to make Trials, whether ſome of theſe heterogeneous Particles, that I found reducible with Mercury into a laſting mercurial Flux, might not ſo alter it, as to diſpoſe it to heat with Gold: And that there were ſuch, thro' God's Bleſſing, my Tryals afforded me poſitive Proof, about the Year 1652.

For when I was alone, that I might not be impoſed upon by others, I took to one part of our Mercury ſometimes half the Weight, and ſometimes an equal Weight of refined Gold reduced to a *Calx*, or ſubtle Powder. This I put into the *Palm* of my Left-hand, and putting the Mercury upon it, ſtirred it, and preſſed it a little with the Fingers of my Right-hand, by which, the two Ingredients were eaſily mingled, and grew not only ſenſibly but conſiderably hot, and that ſo nimbly, that the Incaleſcence did ſometimes come to its height in about a Minute of an Hour, by a Minute Clock. I found the Experiment ſucceed, whether I took altogether, or but half as much Gold as Mercury ; but the Effect ſeemed to be much greater when they were employed in equal Weight.

I tried alſo the ſame Mercury with refined Silver, reduced to a very fine Powder; but I could not perceive any Heat or Warmth at all, tho' I am apt to think, with a ſufficient quantity of *Leaf Silver*, it might have been ſenſible.

I made *Tryal* afterwards oftner than once, in the Hands of others, who were not a little ſurprized and pleaſed at the Event ; particularly having given the Ingredients to the Learned Secretary of the *Royal Society*, I deſired him to make the Experiment in and with his own Hand, in which it proved ſucceſsful within ſomewhat leſs than a Minute of an Hour. (And the L. Viſcount *Brounker*, Preſident of the *R. S.* made the ſame Experiment with ſome of the ſame Mercury, in his own Hand, with good Succeſs.)

This *Incaleſcence* was the more conſiderable, ſince being willing to husband my Mercury, I made theſe *Tryals* but with a Drachm at a time, which ſcarce amounts in quantity to the Bigneſs of half a middle ſiz'd *Bean*, and yet I have ſometimes had of this Mercury ſo ſubtile, that the Heat made me willing to put it haſtily out of my Hand.

However, I will not hence determine, whether thoſe that are *Mercurii Corporum*, and were made, as *Chymiſts* preſume, by Extraction only from Metals and Minerals, will each of them grow hot with Gold, as, if I much miſtake not, I found *Antimonial Mercury* to do. Nor will I affirm, that every metalline Mercury tho' never ſo diſpoſed to *Incaleſcence*, or even that of Silver and Gold it ſelf, is the ſame with that which the *Chryſopæan* Writers mean by their *Philoſophick Mercury*, or is near ſo noble as this. Nay, I will not ſo much as affirm, that every Mercury, obtained by Extraction, even from the perfect Metals themſelves, muſt needs be more noble and fit, as *Alchymiſts* ſpeak, for the *Philoſophick Work*, than that which may with Skill and Pains, be at length obtained from common Mercury, skilfully freed from its Recrementitious and Heterogeneous Parts, and richly impregnated with the ſubtile and active ones of congruous Metals or Minerals. But if there be any truth in what ſome of the moſt approved *Spagyriſts* have delivered about a Solvent of Gold, that ſeems of Kin, and perhaps is not much nobler than one that I had, it ſeems allowable to expect, that even ours ſhould be of more than ordinary uſe, both in *Phyſick* and *Alchymy*.

I had almoſt forgot to tell you, that whereas 'tis uſual to take 4, 5, or 6 nay 8 or 10 parts of *common Quickſilver* to make an *Amalgama* with one of *Gold*, even when both are heated by the Fire ; I found our Mercury ſo congruous to that *metal*, that it would preſently imbody with no leſs than an equal Weight of it, and produce a pretty hard *Amalgama* or Mixture, in which the Mercury was ſo diffuſed, that the Gold had quite loſt its colour. *Secondly*, I ſhall add, what for ought I know, has not been yet obſerved, that this Power of Penetrating Gold, and growing hot with it, is ſo inherent, not to ſay Radicated, in our Mercury, that after it had been Diſtilled from Gold again and again, I found it to retain that Property. And *Laſtly*, I found by Tryal, that a ſingle Drachm of Mercury, made after a certain manner, did the 3*d* or 4*th* Year after I had laid it by, grow ſo hot with *Gold*, that I fear'd 'twould have burnt my Hand.

It may be doubted whether the Good that the *Preparations* of it (ſuch as *Precipitates* and *Turbiths* of divers Kinds, *Mercurius dulcis*, *Cinnaber* made of the *Sulphur* of *Antimony*, and with *Gold*, *&c*) may do in *Phyſick*, is likely much to exceed the political Inconveniences that may enſue, if it ſhould prove to be of the beſt Kind, and fall into ill Hands. The Knowledge of the Opinions of the wiſe and skilful about this Caſe, will be requiſite to aſſiſt me to take right Meaſures in an Affair of this Nature. And till I receive this Information, I am obliged to ſilence. In the mean while, I ſhall make bold to add this Secret, which to ſome I think will ſeem a Paradox, namely, that a *Mercury* qualified to heat with *Gold*, and perhaps with other Powders, may be made by more Ways than by one or two; Experience having aſſured me, that ſuch a Mercury may be prepared, not only by employing *Antimony* and ſolid Metals, as *Mars*, but without any ſuch Metal at all, or ſo much as *Antimony* it ſelf.

I ſhall only admoniſh thoſe inquiſitive *Spagyriſts*, that may be deſirous to try, whether their *purify'd Mercury* be *incaleſcent*, that they be not too haſty to conclude it is not ſo, nor to reject it, unleſs they have made the Trial with *Gold* duly prepared. For the ſmalleſt Filings of *Gold* I could make, or even ſome *Calxes* of *Gold*, will not ſerve our Turn, as I have found by employing, without ſucceſs, a very fine and ſpongy *Calx*, made after an uncommon way, the *golden Particles* having, as it ſeemed, ſome extremely fine tho' unobſerved Duſt of the *Additament* ſticking to them, which hindred the *Adheſion* of the *mercurial ones*. Now the *Calx* of *Gold* that I moſt uſed, as finding it ſtill to do well, was that made by *Quartation*, as *Alchymiſts* call it, That is, by melting together one part of fine Gold, and 3 or 4 parts of *cuppell'd Silver*, and then putting the Maſs, wherein the Metals are mixed almoſt *per minima*, into purify'd *Aqua fortis*, which diſſolving the *Silver* only, leaves the *Gold* in the Form of a fine *Calx*. Alſo, by making an *Amalgama* with *pure Gold* and *vulgar Mercury*, and diſſolving the Mercury in good *Aqua fortis*, there will remain a Powder, which being well waſht in fair Water, to dulcifie it and kept a while in a moderate Fire, to dry it throughly without melting it, will become a *Calx*, which I have more than once uſed with our Mercury with good ſucceſs. I have alſo ſometimes taken, inſtead of a *Calx* of *Gold*, a competent Number of *Leaves* of *Gold*, reduced by beating only, without the help of *Salts*, to a ſufficient thinneſs, inſomuch that 70 odd Leaves did not weigh a *Scruple*, and putting 2 or 3 times the Weight of our Mercury to them, I have found, more than once, that a ſmart Heat was preſently produced in my Hand.

The Silver Mines *in* Hungary, *by* Dr. Edward Brown, n. 58. p. 1196.

CX. There are divers *Silver-mines* at *Schemnitz* in *Hungary*, but the chiefeſt and moſt wrought, are thoſe of *Windſchacht* and *Trinity*.

They have no River here, tho' much Water in the *Mines*, ſo as they are conſtrained to ſend much of their *Ore* to *Hodritz* and other places, where are ſmall Rivers, by which their *Bellows* and *Hammers* may be moved, (their

Ore pounded, waſhed, and other Works requiſite, performed. To draw about the *Engines* to pump out the Water, 12 Horſes at a time are employ'd to each Wheel: But in *Windſchacht-mine*, deep in the Earth, is a large *Wheel* of 12 Yards Diameter, turned about by the Fall of ſubterraneous Water; which, together with the other Water, pump'd from the deepeſt parts of the Mine, runs through a *Cuniculus* made on purpoſe, at the Foot of the Hill.

Trinity-mine is 70 Fathom deep, built and kept open with under work at a great Expence. Much of this *Mine* being in earthy Soil, the *Ore* of it is much eſteemed. Divers Veins lie North; and other rich Veins run to the *North-eaſt*. When two Veins croſs one another, they eſteem it fortunate. They uſe not the *Virgula divina*, and have no certain way to know either which way the Veins run, or where they are, till by the induſtrious perſevering in the Labour of the Mines, they are at laſt found out. They ſhewed me one Place, which they had digged ſtraight on 6 Years, when the *Ore* was but two *Fathoms* diſtant from the Place where they began; and in another Place they digged 12 Years outright, and at laſt found a Vein, which in a ſhort time paid their Charges.

The *Blackiſh Silver Ore* is eſteemed the beſt; much of it hath a Mixture of a ſhining yellow Subſtance or *Marchaſite*, which if it be not in too great a Quantity, is not unwelcome; by reaſon that it diſpoſeth the Ore to Fluidity, or renders it more eaſy to be melted; But if it be in too great a Proportion, they are of Opinion, that it preys upon the Silver in the Mine, and in the Furnace, carrieth it away while it melteth, by Over-Volatilizing it.

There is often found a red Subſtance, which grows to the *Ore*, called *Cinnaber*, *Cinnaber* of *Silver*, *Cinnabaris nativa*, *minium nativum*, or *Berg-Cinnaber*. This Subſtance grinded with *Oil*, maketh a *Vermilion*, equal to, if not ſurpaſſing the *Cinnaber* made by *Sublimation*. I diſcovered a Sulphur in it, by caſting it upon a hot Iron Plate, on which it burned blue. The Miners ſay, they meet not with any Quickſilver, but they find *Cryſtals*, *Amethiſts*, or *Amethiſtine mixtures*, in the Clefts of the Rock, and ſometimes nigh, or joyned to the Ore, as alſo *Vitriol* naturally cryſtallized in the Earth, in divers of the Mines, and particularly in a Mine in *Paradiſe Hill*, near *Schemnitz*.

An Hundred Pound Weight of *Ore* ſometimes yields but half an Ounce, or an Ounce of *Silver*; ſometimes 2 Ounces, 3, 4, 5, and unto 20 Ounces. What is richer is very rare, yet ſome hath been found to hold half Silver, and I have ſeen of it ſo rich, as to be cut with a Knife.

A Specimen of each ſort of *Ore*, which they dig out of the Mines, is carried to an Officer call'd the *Probierer*, who is to prove and judge of its Richneſs, which he doth in this Manner: Of all ſorts of *Ores* he taketh the ſame Quantity: The *Ores* being firſt dryed, burned and powdred, he giveth an equal Proportion of Lead to all, melteth and purifieth them; then by exact Scales, takes Notice of the Proportion between the Ore and the Metal contained in it; and reports it to thoſe employed in the great *melting Furnaces*.

If the *Ore* be found to hold 2½ Ounces or more of Silver in 100 Pound Weight, they ordinarily melt it, without any foregoing Preparation, by the help of *Iron-Stone*, (which is not *Iron-Ore*, but a Stone found thereabout, of which the *Liver-Coloured* is the beſt) *Kys*, (a ſort of *Pyrites*) and *Slacken*, (a *Scum* or Lake taken off from the top of the Pan, into which the melted *Mineral* runs, and is a ſubſtance made out of the former mentioned by *Fuſion*;) which are thrown in with it into the melting Furnace.

If the *Ore* be poorer, holding but 2 Ounces in an 100 Pound Weight, or leſs, it is firſt Pounded and Waſhed, till it becomes Richer, or hath a greater Proportion of Metal in reſpect of the Ore, much of the Earthy parts being waſhed away. Then it is thrown into the *Furnace* with the former Materials; and the *Marchaſite*, which remains ſtill with it, as ſinking always to the bottom with the Silver in the Waſh-works, helps to the quicker *Fuſion* of the Ore.

Whatſoever is melted in the melting *Furnace*, is let out through an hole at the bottom thereof into the Pan, which is placed in the Earth before it; and, thus expoſed, it immediately acquires an hard Scum, Droſs, Loat, or Cake, which being oft taken off from the top, the metal Remaining in it becomes purer; to which is added Lead, and after ſome time the melted Metal is taken out. Then being again melted in the Driving *Furnace*, the Lead, or what elſe remains mixt with the Silver, is driven off by the blowing two great Bellows, and runs over in the form of *Litharge*. That which firſt comes over is the White, and that which is laſt, being longer in the Fire, is the Red; not that it is *Litharge* of Gold, both being driven off from the ſame Metal.

Moſt of the *Schemnitz-Silver* Ore holds ſome Gold; which they ſeparate by melting the Silver, then *Granulating* it, and afterwards by diſſolving it in *Aqua-fortis*, whereby the Gold is left at the bottom, and is afterwards melted. The *Aqua-fortis* is diſtilled from the Silver, and ſerveth again for uſe.

The Silver then ſeparated from all its former Aſſociates, is ſent to *Cremnitz*, where they Coin it into Pieces of a mixt Metal, (which is the common Money of the Country) after this manner. They melt it with about the ſame Quantity of Copper, and run it into Bars, which they beat out; then ſoftening them in the Fire, draw them out to an exact Thinneſs between two Steel Wheels; then they cut them out into round Pieces with an Inſtrument like a Shooe-maker's Punch; and then boil them with *Tartar* and *Salt*, ſhake them in a Sack with Small Coal and Water, dry them in a Kettle Perforated, and afterwards they are drawn between two Wheels, in which they receive their Stamp.

The Gold Mines *in* Hungary, *By Dr.* Edward Brown. n. 58. p. 1192.

CXI. Among the 7 Mine-Towns in *Hungary* (which are not far from one another, *viz. Chremnitz*, *Schemnitz*, *Newſol*, *Koningsberg*, *Bochantz*, *Libeten*, and *Tiln*) *Chremnitz* is the Richeſt in Gold. They have alſo, at preſent, Gold Mines at *Bochantz* and *Coningsberg*; and they report in that Country, that there hath been formerly a rich Gold Mine at *Glaſs Hitten*, but loſt ſince that *Bethlem Gabor* over run thoſe Parts, when the Undertakers ſtopped up the Mine and fled.

They have worked in the Gold Mine at *Chremnitz* 900 Years. This Mine is diverſe *Engliſh* Miles in length, and about 160 Fathoms deep. Many Veins of the Ore run to the North, and to the Eaſt. They Work alſo towards one, two and three of the Clock, as they ſpeak: for the Miners direct themſelves under Ground by a Compaſs, not of 32 Points (ſuch as is uſed at Sea) but by one of 24; which they divide, as we do the Hours of the Day, into twice Twelve. Of the Gold Ore, ſome is White, and ſome Black, Red, or Yellow: That with Black Spots in White is eſteemed the beſt, as alſo the Ore which lieth next to the black Veins. This Ore is not rich enough to ſuffer any Proof in ſmall Parcels, like that in other Mines, whereby to know what Proportion of Metal is contained in it; but they Pound a very great Quantity thereof, and waſh it in a little River, which runs nigh the Town. The whole River being divided, and admitted into diverſe cuts, runs over the Ore continually, and ſo waſheth away the Earthy parts from the Metalline: And from a clear River above the Town, by its running through ſo many Works, and over ſo much Pounded Ore, it becomes below the Town, a dark yellow Stream, of the Colour of the Earth of thoſe Hills.

There have been Pieces of Pure Gold found in the Mine. Some of which I have ſeen in the Emperor's Treaſury, and in the Elector of *Saxony*'s *Repoſitory*; one Piece as broad as the Palm of my Hand, and others leſs and upon a white Stone many pieces of Pure Gold; but theſe are very Rare.

The common Yellow Earth of the Country near *Chremnitz*, although it be not eſteem'd Ore, affords ſome Gold: And in one Place I ſaw a great part of a Hill digg'd away, which hath been caſt into the Works, waſhed and wrought in the ſame manner as Pounded Ore, with conſiderable Profit.

Some Paſſages in this Mine, cut through the Rock, and long diſus'd, have grown up again, and I obſerved the ſides of ſome, which had been formerly wide enough to carry their Ore through, to approach each other, ſo as we paſſed with Difficulty. This happens in Moiſt Places. The Paſſages unite not from the top to the bottom, but from one ſide to another.

There is *Vitriol* in this Mine, White, Red, Blue and Green; and alſo *Vitriol Waters*. There is a Subſtance found, which ſticks to the Gold Ore, of ſmall pointed parts like Needles, call'd by them *Antimony of Gold*. There are Cryſtals found here, and ſome tinctur'd Yellow.

The Miners will not allow any Quickſilver or Brimſtone to have been found here; yet in the lately mention'd *Antimony of Gold*, there is evidently *Sulphur*, as I perceived by Burning. The Quickſilver Mine, mention'd in the Anſwer to *Kircher*'s *Inquiries*, *Mund. Subter.* is an *Hungarian* Mile, or ſeven *Engliſh* Miles diſtant from *Chremnitz*; and is not wrought in at Preſent.

There is a *Vitriol* Mine in theſe Hills near the Gold-Mine; the Earth or Ore of it is Reddiſh, and ſometimes Greeniſh. This Earth is infuſed in Water, and after 3 Days, the Water is poured off, and boiled 7 Days in a *Leaden Veſſel*, till it comes to a thick granulated Whitiſh Subſtance, which is afterwards reduced to a *Calx* in an *Oven*, and ſerveth in the making *Aquafortis*, or the ſeparating Water, uſed at *Schemnitz*.

They have divers ways of taking the Gold out of its Ore; by burning the Ore, by Melting, by adding Silver Ore and other Minerals, Sand, and Lead, as they find the Ore Fluid or Fixt. But without Lead they proceed thus:

They break and pound the Ore in Water very fine; the waſh it often, and lay it in Powder upon Cloaths, and by the gentle Oblique deſcending of the Water over it, and their continual ſtirring it, the Earthy, Clayiſh, and lighter Parts, are waſht away, while the heavier and *Metalline* remain in the Cloaths; theſe Cloaths are afterwards waſht clean in ſeveral Tubs, and the Water after ſome Settling, poured off from its Sediment, which Sediment is again waſht, and ſtirred up in ſeveral Veſſels and Troughs, till at length they ſprinkle *Quickſilver* upon it, and Knead it well together for an Hour, and then waſhing it again in a Wooden Veſſel, after the ſeparating of much of it which the *Quickſilver* touches not; by ſtriking this Veſſel againſt their Leg, they bring the Gold and *Quickſilver* together, in an *Amalgama*, to one Corner of it. From this *Amalgama* they ſtrain as much of the *Quickſilver* as they can through Coarſe Cloaths firſt, and then through Fine; then they put the Maſs remaining upon a perforated Plate, which they ſet over a deep Pan placed in the Earth, in the bottom of which Pan they alſo put *Quickſilver*; this Pan they cover, and *Lute* the Cover well, and then making a Charcoal Fire upon it, they drive down the *Quickſilver*, yet remaining in the Gold, to the reſt in the bottom of the Pan; then taking out the Gold, they caſt it into the Fire, that it may become Purer.

Concerning *Cranach-Gold*, I cannot learn, that there is any ſuch Gold, or Place where Gold is digg'd, in *Hungary*; but in *Germany* I think there is, for *Agricola* mentions ſuch a Place as *Golde-Cranacum*, and another call'd *Golde-Crona*.

The Extreme Ductility, and Exceeding Minuteneſs of the Conſtituent Particles of Gold; By Mr. Edmund Halley. n. 194. p. 540.

CXII. It is evident from undoubted Experiment, that *Gravity* is in all Bodies Proportionable to the Quantity of Matter in each, and there is no ſuch thing as a Propenſion of ſome more, others leſs, towards the Earth's Center; ſince the Impediment of the Air being removed, all Bodies deſcend, be they never ſo looſe or compact in Texture, with equal Velocity. It follows therefore, that there is 7 times as much Matter in Gold as in a piece of Glaſs of the ſame Magnitude (their *Specifick Gravities* being nearly as 7 to 1) and conſequently, that at leaſt 6 parts of 7 in the Bulk of *Glaſs*, muſt be *Pore* or *Vacuity*. This ſome Favourers of the *Atomical Philoſophy* have endeavoured to ſolve, by ſuppoſing the Primary or *Conſtituent Atoms* of *Gold* to be much larger than thoſe of other Bodies, and conſequently the *Pores* Fewer.

In order to Examine the Magnitude of thoſe *Atoms*, I informed my ſelf among Wire-Drawers that the very beſt Double-gilt Wire, was made out of Cylindrick Ingots 4 Inches in Circumference, and 28 Inches long, which weigh 16 pounds *Troy*; on theſe they beſtow 4 Ounces of *Gold*, that is, to every 48 Ounces of Silver, one of *Gold*: and that 2 Yards of the *Superfine Wire* weighs a *Grain*. Hence at firſt ſight it appeared, that the length of 98 Yards is in Weight 49 *Grains*, and that a ſingle *Grain* of *Gold* covers the ſaid 98 Yards and that the 10000*th* part of a *Grain* is above $\frac{1}{8}$ of an Inch long; which yet may be actually divided into 10, and ſo the 100000*th* part of a *Grain* of *Gold* be viſible without a *Microſcope*. And by means of the *Specifick Gravities* of the Metals, *viz.* *Silver* $10\frac{1}{2}$ and *Gold* $18\frac{1}{3}$. I found the Diameter of ſuch Wire, the $\frac{1}{186}$ part of an Inch, and its Circumference the $\frac{1}{59}$ part: but the *Gold* in thickneſs not to exceed the $\frac{1}{134500}$ part of an Inch; whence it may be concluded, that the Cube of an hundred part of an Inch would contain above 2433000000, (or the Cube of 1345) of ſuch *Atoms*. And yet tho' the *Gold* be ſtretcht to ſo great a Degree as is here demonſtrated, it ſhews it ſelf of ſo even and united a Texture, as not to let the White Colour of the Silver under it appear (even with a *Microſcope*) through any the leaſt *Pores*; which Argues that even in this exceeding thinneſs, very many of thoſe *Atoms* may ſtill lie one over the other.

A Mineral like Leaf-Gold near Mexico; By an English Gentleman at Seville. n. 41. p. 817.

CXIII. 1. *An.* 1664. I travelled into the Kingdom of *Mexico*, under the Character of a *Biſcaner*, and remained in that Country about 2 *Years*.

Some of the Minemen ſhewed me certain Stones, gathered in great abundance in the Mines of *Taſca*, which they would have to be *Amethyſts*.

There is a famous Cave, ſome Leagues from *Mexico*, on the North-weſt ſide of the City beyond the Lake. I found it ſituated ſomewhat high, in a place very convenient for *Generation* of Metals. The Light of a Candle ſoon diſcovered to me on all ſides, but eſpecially above my Head, a gliſtering Canopy gilded with a kind of *Leaf-Gold*. I heaped together a quantity of the Mineral mixt with Sand, and ſcraped alſo from the Superficies of the Earth, a quantity of the ſame kind of Mineral Leaves; none of which exceed the breadth of a Man's Nail; and with the leaſt handling they divide themſelves into many leſſer Spangles; with a little rubbing they leave ones hand all gilded over like *Gold*, and they equalize the moſt refined *Gold* upon the Touchſtone.

It is reported that the Antient *Indians* knew how to make uſe of this Mineral. But the *Spaniards* have never been able to reduce it into a Maſſy form by the Violence of the Fire or ſeparate it from Heterogeneous Subſtances by the mild Tryal of *Quickſilver*. Some indeed of the choiceſt Mines of *Silver* and *Gold*, are almoſt of the like Nature, till the Impediments are removed, which are certain *Mineral Viſcoſities*, that ſometimes by their *Oleaginous* fatneſs, and at other times by a fretting *Acrimony*, hinder the ingreſs of the Mercury.

To find out therefore a Cure for this Diſeaſe I began to make Experiment on the Sand, which had been the *Matrix* of the Mineral. I try'd it in a ſtrong *Reverberating Fire*, but it did not afford any Viſible Fumes. I then boiled ſome of it in Water, and having poured that off, I obſerved the *Alcali*, left after the Waters *Evaporation*: and thereby I diſcovered, that it abounded rather in *Sulphureous Unctuouſneſs*, than *Saline Acrimony*. Finding this, I applied firſt the *Quickſilver* mingled with the Ordinary *Magiſtrals* (as they call them) uſed in that Country, to Curb and break the force of the *Sulphureous* Impediments. But perceiving theſe to be of no Effect, I encouraged the *Quickſilver* with the *Caput mortuum* of *Vitriol* or *Salt Petre*, (kept as a Secret among the Chiefeſt Mine-men) but with as little Signs of the Mercuries Operation as before. Then I boiled my Mixture over the Fire; a way found out in *Peru* in ſuch difficult Caſes; but all to no purpoſe. Then I deviſed a way to Torment it with a *Corroſive* or ordinary Separated Water, Impregnated with common Salt, and it made a Diſſolution exactly like that of Gold: But having ſteamed away the *Aqua-Fortis*, I found a Dirt ſomething Yellow, out of which with Diſtilled Vinegar, enforced with its own *Tartareous Salt*, I Extracted a Tincture more Curious than uſeful.

An Experienc'd *Mineraliſt Cemented* it with the Powder of *Vulgar Sulphur*, *ſtratum ſuper ſtratum*, and this in a Moderate Fire for 3 Days together; hoping the Sulphur would conſume all the Impediments, which kept the Mercury from entring: But (as I told him before hand) it only ſerved to Clog the matter with more *Sulphureous Unctuoſity* than it had before.

2. When Silver is generated, as commonly 'tis, in certain Rocky Stones, abounding with *Bituminous Corroſive* Mixture, ſo as 'tis Impoſſible to free it totally from its corrupt *Matrix* by the violent way of Melting, what ever Auxiliary Ingredients may be added, as Lead and *Artificial Salts*, and the like because thoſe *Sulphureous* and *Vitriolick* Compounds, (in the way of *Fuſion*) meeting together with the Silver, Sublime part of it away, in a Volatile Fume, by their Corroding *Acrimony*, *Calcinating* and *Vitrifying* the other part, and Robbing the Artificer of half his gain; in this caſe the uſe of Quickſilver is found moſt Advantageous. The Practice thus:

The uſe of Mercury *in* Separating Silver *from the* Ore; *By the ſame* Engliſh Gentleman. ib. p. 820.

Having reduced the *Ore* into ſmall ſtones, they Calcine it firſt in a *Reverberating Oven*, yet with a Moderate Fire for fear of *Fuſion*; and driving away into the Air part of the Treaſure; the *Volatile* parts being by nature not perfectly mixt *per minima* with the Fixt, as they afterwards come to be by Induſtry and Art. And I have heard ſome of the more Intelligent *Mineraliſts* ſay, that they Judge their *Metallick* Labours and Operations to be many times not ſo much a Reaping of Silver ready made, as a kind of Artificial Compounding, and Bettering of that, which Nature had left diſperſed and imperfect.

This *Calcination* ſerves, chiefly to free the Mineral from many Infirmities, that hinder the Operation of the Quickſilver; and it ſerves alſo to diſcover by the Colour of the Fumes it yields, what *Corroſive* Mixture chiefly abounds in it: beſides that, it renders the *Ore* more Tractable and Pliant under the Mill-Stone, which is to reduce it to ſmall Flower, before the Application of the Mercury. This is chiefly obſerved in thoſe Silver Veins, that are of a hard and dry Complexion; yet thoſe which are uſually more ſoft, abounding in *Oleaginous Sulphurs*, before Burning, are firſt ground into powder in ſuch Mills, as I have often ſeen in Glaſs-houſes, and then they receive a gentle *Calcination*, the Mineraliſt mingling therewith Suitable Ingredients. As if (*e.g.*) the Metal be *Sulphureous* and *Antimonial*, Ruſt and Droſs of Iron is found to be an excellent Cure of this Diſtemper: If Martial, and abounding in Iron, then *Sulphur* and *Antimony* reduced to Powder. And I have found by Experiment that *Sulphur* has a particular force to ſoften and diſſolve Iron.

The *Ore* being ground, Calcin'd and curiouſly Sifted, they divide it into ſeveral heaps, and then by leſſer Eſſays, they find out how much Silver is contained in every heap; where 'tis very ordinary to find only 6 Ounces in 100 Pounds; ſometimes 12, but if it yield 18, 'tis eſteemed a very Rich Vein; yet ſometimes there are great Maſſes found all of Pure Silver, which is called Virgin Metal. Then Proportionable to the Quantity of Silver in each heap they beſprinkle them with *Quickſilver*, and that not all at once, but at ſeveral times, ſtirring the *Ore* up and down. If the Mercury gives ſigns of being *Tocado* (as they call it) *i.e.* if it appear Mortified, not in ſmall and clear ſpherical Figures (which is a good Prognoſtick) but in the form of long Worms of a wan, Pale, Dark and Leadiſh Colour, (which indicate that the Ore abounds with Lead and Pewter) it is cured by certain *Magiſtrals* which have for their Baſis or Maſter Ingredient *Calcin'd Copper* mingled with Salt.

The heaps of Ore being thus mingled with Quickſilver, they are often ſtirred about, the better to Incorporate it with the Silver. I find, that they have none but Conjectural Signs to know, when the Mercury hath entirely performed its Office in ſeparating all the Silver from thoſe *Heterogeneal* Subſtances; the uncertainty whereof occaſions often very great Loſſes, eſpecially when they Work about Gold; for in paſſing the right time, the greateſt part of the *Gold* flies away in a Fume. But when by the Colour of the Mercury, Coagulated by the Silver in clear Maſſy Lumps, the Conjecture the Work done, they waſh it by means of three Veſſels ſtanding in order the one under the other, ſo that the Matter in the firſt and higheſt Veſſel being waſhed and ſtirred about with a Mollinet, all the Duſt of the *Heterogeneous Minerals*, that imbody not with the Mercury, is carryed away together with the Water into the other Veſſels, and from thence is quite thrown out by the continual current of the Water; whereas in the mean while the Silver in clotted lumps, called *Pellas*, is by the weight of the Mercury depreſſed down to the bottom of the Tubs. Then the Mercury with the Silver is taken out of the Veſſels, and diligently ſqueezed in courſe and ſtrong Linen, and even with ſtrokes of a Beetle, the Quickſilver is ſeparated as much as may be from the Silver. And this Maſs is afterwards reduced, of Molds of the ſhape of the *Indian* Pine apple, into a Pyramidal or *Conical* Figure, which they call *Pineas de Plata*, thus faſhioned for the eaſier placing them round about the ridges of a great Earthen Veſſel, of the form of a blind Alembeck, round about the top of which a Fire being made, all the reſt of the Mercury forthwith abandons the Silver, and falls to the bottom, from whence it is recovered, and kept for the like uſe.

Laſtly, The *Silver* is melted down with the *Liga*, (as 'tis call'd) which the King of *Spain* allows, by which he returns to the People in *Copper* that Fifth Part, which they allow him of all the *Silver*.

Vegetable Silver. ib. 823.

I have obſerved, that there is a very ſtrong Offenſive Smell, Ranker than that of *Sepulchres*, in ſome Mines; the Workmen telling me, that that is one of the chief Signs of a Rich Mine.

A Friend of mine ſhewed me a very pretty Experiment more Curious than gainful; it was a continual Budding forth of Silver in the form of a *Branch*, in a Glaſs, over an indifferent ſtrong Fire of Coals; which Sprouts being clipped off with Sciſſers, and a ſmall ſupply of *Crude Mercury* added to the Matter, in a ſmall time there aroſe another Branch of true *Silver*, which had ſucked and converted into *Metallick Sprigs*, a conſiderable Portion of the Quickſilver. This Motion and the Increment of new *Silver Branches* Ceaſed not, as long as the Fire was continued, and freſh Mercury applyed, for the due Nutriment of this *Mineral Vegetation*. This whole Complex of Ingredients is known to conſiſt only of vulgar *Aqua-fortis* (abſtracted from two Parts of *Vitriol*, and one of *Salt Peter*) and Quickſilver, and a ſmall quantity of Silver, far leſs than you may Reap in a ſmall time from theſe Silver Sprigs, yet Gain there is none, there being more Expences blown away into Smoak, by the continuance of Fire in one Month, than can be recovered from this Silver Harveſt in a longer time.

I am of Opinion that in all *Tranſmutation* of Metals the Imperfect Metal is not totally Transformed into the more Perfect, by the Subſtance mixed with it: But that the Mixture added to the melted Metal, joins it ſelf, (as I conceive) to thoſe Parts, which being *Homogeneal*, Symbolize together with the Nature of the more Perfect, whereby the Pure *Metalline* parts are ſeparated from the other *Heterogeneal Impure Sulphurs*.

The Art of Refining; By *Dr.* Chr. Merret. n. 142. p. 1046

Parting.

CXIV. The End of Refining is the Separation of all other Bodies from Gold and Silver, which is performed four ways, *viz.* by Parting, by the Teſt, by the *Almond Furnace* or the Sweep, and by Mercury. 1. Parting is done with the *Aqua-fortis*, Some *Refiners*, to make the *Aqua-fortis*, take *Salt Peter* 3 Pound, and *Dantzick* (not *Engliſh*) *Vitriol* 2 Pound (for the *Engliſh Vitriol* makes a weaker Water, and a dirty colour'd *Verditer*, and wholly ſpoils it.) After they are well bruiſed and mixed in a Mortar, they Diſtill 100 Pound of the Materials, put into a caſt Iron Pot, after this manner.

Build a *Furnace* 2 Yards high or more; and at the top place in your Iron Pot: To which fit a Head of Earth, like the Head of a large Diſtillation for *Chymical Oyls*, which muſt have a large Belly, branching it ſelf out 8 Inches from the Iron Pot, into 3 Branches; one whereof in the midſt, comes directly ſtraight forwards, two other Lateral ones come obliquely: All which Branches are 4 or 5 Inches hollow in Diameter, and 5 or 6 long. To theſe Branches are fitted Glaſs Bodies, narrow and hollow at both Ends, large and Globous in the midſt. Theſe muſt be exceedingly well Luted on with Colcothar, Rags, Flower, and Whites of Eggs. To this firſt Glaſs Body is Luted on another Glaſs, of the ſame Figure and Size, and in order 8 alike in all, till they come to the *Receiver*, which is an Ordinary Gallon Glaſs. All theſe Rows of *Glaſſes* lie on Boards, ſhelving from the Head to the *Receiver*. The two upper *Receivers* or *Glaſs Bodies* need exceeding good Luting, for the reſt Ordinary Lute will ſerve.

The Lute is made of good Loam, ſome Horſe Dung, and a little *Colcothar*; although the two former do well.

A little Fire and that of *Newcaſtle-Coals* does the Work: And you need never break or *Unlute* any of the *Receivers*, but the lowermoſt.

The *Aqua-fortis* being Diſtilled off, is put into a large Earthen Pot, and there is added of Fine Silver, one or two Penny Weight (which is called *Fixes*) to every Pound of *Aqua-fortis*, which within four Hours will Purge it from all Dirt and Impurity, and make it fit for Parting, which is thus done.

If their Silver gilt be fine enough for Wire, they only Melt it in a Wind Furnace, and caſt it, melted into a large *Tub* of Water, that they may have it in ſmall Pieces; but if it be but Standard, they firſt Fine it on the *Teſt*. Theſe ſmall Pieces taken from the Water, being well dryed, are put into a *Glaſs* Taper-faſhion'd, a Foot high, and 7 Inches at the bottom; and then the *Glaſſes* are charged with *Aqua-fortis* about 2 thirds of it, and ſet in a Range of *Iron* Covered two Inches deep with Sand, and a gentle Charcoal Fire is made under it.

Small Bubbles will ſoon ariſe, and the Water alſo run over. If ſo they take off the *Glaſſes*, and hold them till it doth *Deferveſcere*, or elſe pour out ſome of it into a Veſſel which is at Hand.

If Lead be mixed with it, they cannot keep it from Running over.

When the Water hath been once Quieted, from this *Ebullition*, it will riſe no more.

The *Greenneſs* of the Water, manifeſteth the quantity of *Copper* contained in it.

If the Water boil over, 'twill Penetrate the Bricks and Wood.

They commonly let it ſtand a Night on the Iron-Range, with a gentle Heat under it, and in the Morning ſoftly pour off the Water Impregnated with all the Silver; all the Gold lying like black Dirt at the bottom; which being waſhed out is put into ſmall *Parting-Glaſſes*, and ſet over the Sand with their Conduit Water for an Hour, and then the Water poured off. This is repeated 5 or 6 times, to ſeparate the Salt from the *Gold*, which is now fit to be melted, and caſt into *Ingots*.

To Regain the Silver, they have large round Waſhing Bowls, lined within with melted Roſin and Pitch (for otherwiſe the Water would eat the Wood and penetrate the ſides of the Bowl) covered with *Copper Plates* 10 Inches long, 6 wide, and half or more thick. Into which Bowls they pour good ſtore of Water (the more, the better the *Verditer*) and then the Silver Water; which Working on the ſofter Metal of *Copper*, leaves all the Silver in moſt fine Sand at the bottom, and ſides of the Bowl, and Plates of *Copper*; which being taken out, is waſhed, dryed and melted for any uſe.

If any *Braſs* or *Shroffe Metal* be in the Plates, they gather very little of the Silver; the latter mixing with the Silver.

With the *Copper-water*, poured off from the *Silver*, and *Whiting*, *Verditer*, is made thus. They put into a *Tub* a *Hundred Pound* weight of *Whiting*, and thereon pour the *Copper Water*, and ſtir them together every Day for ſome *Hours* together. And when the Water grows pale, they take it out, and ſet it by for farther uſe, and pour on more of the *Green Water*; and ſo continue till the *Verditer* be made; which being taken out, is laid on large Pieces of *Chalk* in the *Sun*, till it be dry for the Market.

The *Water* mention'd to be taken from the *Verditer*, is put into a *Copper*, and boiled till it comes to the Thickneſs of *Water-Gruel*, now principally conſiſting of *Salt Petre* reduced, moſt of the *Spirit* of *Vitriol* being gone with the *Copper* into the *Verditer*, a Diſh full whereof being put into the other Materials, for *Aqua-fortis*, is re-diſtilled, and makes a *Double water*, almoſt twice as good as that without it.

2. By the *Teſt*, all *Metals* are ſeparated from Silver, except *Gold*, becauſe they ſwim over it, when they are all melted together. The Teſt.

The *Teſt* is thus made. They have an *Iron Mould*, Oval, and two Inches deep. At the Bottom hereof are 3 *Arches* of *Iron*, ſet at equal Diſtances, 2 Fingers wide, if the great Diameter of it be 14 *Inches* long, and ſo proportionably in greater or leſſer *Teſts*. This Cavity they fill with Fine Powder of *Bone-Aſhes*, moiſtened with *Lixivium*, made with *Soap-Aſhes*. Some uſe Cakes of *Pot-Aſhes*, or other Aſhes well cleanſed, and ſo preſſed well together with a *Muller*, that it becomes very cloſe and ſmooth at the Top. There is left above, a Cavity in the midſt of it, to contain the melted Silver. This Cavity is made greateſt in the middle, for the *Bone-Aſhes* come up parallel to the Circumference of the *Mould*. only a ſmall Channel in that end which is moſt remote from the Blaſt, for the Running off of the baſer *metals*, and ſo is made *Declive* to the Center of the *Teſt*, where 'tis not above half an Inch deep.

The *Teſt* thus made, is ſet *Annealing* 24 *Hours*, and then 'tis ſet in a *Chimney* a Yard high, parallel almoſt to the Noſe of a great pair of Bellows, and then therein is put the Silver, which being covered all over with Billets of *Barked Oak*, the *Blaſt* begins, and continues all the while ſtrongly. The *Lead* purify'd from all Silver, (which they call the *Soap* of *metals*) firſt put in, melts down with the Silver, and then the Lead and Copper ſwim at the Top, and run over the *Teſt*. Whoſe Motion the Refiner helps with a long Rod of *Iron* drawn along the Surface of the *Silver*, towards the fore-menmention'd Slit, and often ſtirring all the Metal, that the Impurer may the better riſe, and by continuing this Courſe, Separation is made in 2 or 3 *Hours*.

The greateſt part of the Lead flies away in Smoke.

If the *Lead* be gone before all the Copper, 'twill riſe in ſmall red fiery Bubbles, and then they ſay the Metal drives, and muſt add more Lead. The Force of the Blaſt drives the higher Metals to the lower ſide of the *Teſt*, and helps its running over.

When the Silver is fully fined, it looks like moſt pure Quickſilver; and then they take off their Sogs, and let it cool. In the Cooling, the Silver will frequently from the Middle, ſpring up in ſmall Rays, and fall down again. If moiſt Silver be put into that which is melted, 'twill ſpring into the Fire.

A good *Teſt* will ſerve 2 or 3 Firings.

So ſoon as the Silver will hold together, they take it out of the Teſt, and beat it on an *Anvil* into a round Figure, for the melting Pot, which being ſet in a *Wind Furnace*, ſurrounded with Coal, and covered with an iron Cap that no Charcoal fall into it, is then melted.

If any Droſs or Filth be in the Melting Pot, they throw in ſome *Tincal*, which gathers the Droſs together, that it may be ſeparated from it.

Theſe melting Pots are never *Burned* but only dryed, and laſt a whole Day, if they be not ſuffered to cool, but if they once cool, they infallibly crack.

The Almond Furnace.

3. In the *Almond Furnace*, or *Sweep*, all ſorts of Metals are ſeparated from Cynders, parts of melting Pots, Teſts, Brick, and all other harder Bodies; which muſt be firſt beaten into ſmall Pieces with a *Hammer* on an Iron-Plate.

Thoſe which ſtick but ſuperficially to the Silver, they waſh off thus, they have a wooden round *Inſtrument* two Foot wide, ſomewhat hollow in the Middle, with a Handle on each ſide. On this they put the Materials, and hold them in a Tub of Water below the Surface, and ſo Waving it too and fro, all the lighter and looſer Matter is ſeparated from the Metal.

The *Furnace* is 6 Foot high, 4 Foot wide, and 2 Foot thick, made of Brick: having a Hole in the midſt, at the Top 8 Inches over, growing narrower towards the Bottom of it, where on the Fore-part, it ends in a ſmall Hole, environed with a Semi Circle of Iron, to keep the molten Metal. About the middle of the Back, there is another Hole to receive the Noſe of a great pair of Bellows.

When the *Furnace* is annealed with Charcoal and hot, they throw two or three Shovels of Coals to one of the forementioned Stuff, and ſo proceed during the whole Work, which continues three Days and Nights, without Intermiſſion. After Eight or Ten Hours, the Metal begins to run, and when the Receiver below is pretty full, they lade it out with an Iron Ladle, and caſt it into Sows in Cavities, or Forms, made with Aſhes.

They frequently ſtop the *Paſſage-Hole* with Cynders, to keep in the heat, and when they think a Quantity of Metal is melted, they unſtop the Hole to paſs it off.

If the Stuff be hard to flux, they throw in ſome *Slag*, which is the Recrement of Iron, to give it Fuſion.

A ſtinking blue Smoke proceeds from the *Furnace*, and all the By-Standers put on the Colour of Dead Men.

By Quick-ſilver.

To get the *Silver* from theſe Metals, and to refine their Copper from the Litharge, they now uſe no other Art than that of the Teſt.

By Quickſil-ver.

4. By *Quickſilver*, the Filings of Gold and Silver are ſeparated from *Duſt &c.* This *Duſt* is put into a Hand-Mill with *Quickſilver*, and being continually turned upon that and the *Metals*, an *Amalgama* is made of them, and fair Water poured in, carries off the *Duſt*, as it runs out again by a ſmall *Quill*.

This *Amalgama* is put into an Iron, with a *Bolt-heal* ſet into the Fire, having a long iron Neck 3 Foot long, to which is fitted a Receiver. The Fire diſtills off the *Mercury* into the *Receiver*, and the Gold and Silver remain in the *Bolt-head*.

Experiments of refining Gold *with* Antimony, *by* Dr Jonat Goddard, n. 138. p 953. With freſh Antimony.

CXV. 1. There was taken of *Crown Gold* (which is as they call it, of 22 *Kerats* Fine, or $\frac{11}{12}$; and the *Alloy* is part Silver, part Copper, more of the *Copper* for the moſt part) to the Quantity of 178 Grains. This was melted down with 2 *Ounces* and 2 *Drams* of *Antimony* (about 6 times as much as the Gold.) And becauſe the *Gold* was put in *Plates*, for the more certain *Melting* and *Mixture*, the Firſt *Regulus* of Gold being ſeparated from the *Antimony*, both were powdered apart. and the *Regulus* in the *Melting-Pot* laid upon the ſame *Antimony*, and ſo both melted down again. In both which Meltings, ſuch an Heat was given, as made all of a clear Light, even red hot and boyling. Then the Pot was taken out of the Fire, and all permitted to ſeparate, ſettle and cool in it. Upon the breaking the Pot, the of Gold (being very diſtinct in the bottom, and eaſily ſeparated from the *Antimony*) weighed 163 Grains.

N. B. That this way of cooling all in the Pots was obſerved in all the following *Experiments*, for the more certain Separation and Settlement of the *Regulus*, without *Effuſion* into the *Antimony-Horn*, (as they call it) or hollow Iron Cone. Which *Effuſion* by *Confounding* and *Cooling* the Mixture, may be ſome hindrance to a more perfect Separation. And to be ſure, in the bottom of the Cone, there is always a thin *Cruſt* of the *Crude Antimony*, troubleſome to be ſeparated, without taking off ſome part of the *Regulus*.

Note alſo, that *Borax* was uſed in every Pot, for Prevention of the ſticking of the *Regulus* to the Bottom, and the *Antimony* to the ſides of it, ſo that both were gotten off clean, and in full *Quantity*.

Of the *Regulus*, a piece was broken off, which weighed $38\frac{1}{2}$ Grains, and was kept to be Refined upon the Coppel apart; the Weight of the Remainder therefore was $124\frac{1}{2}$ Grains, which being powder'd and put upon $2\frac{1}{4}$ Ounces of freſh Antimony and melted down, the *Regulus* weighed 74 Grains.

The other Pieces of $38\frac{1}{2}$ grains being refined on a Coppel, from the Antimonial Subſtance mixed with it. (by *Exhalation*, promoted ſometime with a Blaſt upon it, eſpecially toward the latter End, as in all the following *Experiments* of refining upon the *Coppel*, $30\frac{1}{2}$ *gr.* and upon melting with *Borax* in *Crucible*) loſt not above half a grain. So that the Weight of the whole to the Gold it held, was as $38\frac{1}{2}$ to $30\frac{1}{2}$, or the Gold almoſt $\frac{5}{6}$ of the whole. The latter *Regulus* weighing 74 *gr.* being refined in the ſame manner,

weighed

weighed 63 *gr.* the Gold holding Proportion to the whole, as 63 to 74; that is, near upon $\frac{6}{7}$ of the whole, So that the ſame *Regulus* of Gold and Antimony, in paſſing thro' *New Antimony*, tho' it loſe in Weight, yet it is richer in Gold; and appears ſo to Senſe, being of a redder *Complexion*, more *tough* and *harder* to Powder.

Both the Parcels of *Antimony* were ſeverally *mixed*, with equal Weight, both of *Tartar* and *Nitre*, and then Fired, and ſo reduced to a *Regulus*. Then the *Regulus* of each, *Exhaled* and blown off upon *Coppels*. Of the firſt Parcel of *Antimony* wherewith the Gold was firſt melted, the *Regulus* being *Exhaled*, there remained in Gold 36 *gr.* Which upon melting in a *Crucible*, loſt ſomewhat, but ſcarce half a *gr.*

Of the ſecond Parcel of *Antimony*, wherewith the Firſt *Regulus* of Gold and Antimony, weighing 124$\frac{1}{2}$ *gr.* was melted, there remained in Gold 27 *gr.*

All the other Parcels were fine Gold to Senſe, upon the *Touch*, only that out of the firſt *Antimony*, was apparently *Unfine* and *Pale*. from the Silver, in the Original Alloy mixed with it, as appeared by comparing on the *Touch-ſtone*, with ſovereign Gold allayed with Silver; holding (to the Judgment of Senſe) about a *4th* Part of Silver, as the Sovereign Gold doth a *6th*. Neither was it altogether free from Copper; becauſe upon *Nealing*, it always turned black on the Surface. But for the more *exact* Diſcovery, it was taken and firſt refined with Lead upon a *Coppel*, for Separation of any Copper that might be in it. Upon which Operation, it came forth 33$\frac{1}{2}$ *grains*, which was 2$\frac{1}{2}$ *grains* leſs than it was before. Afterwards this laſt was melted, with betwixt two and three Parts of Silver, and ſo wrought in *Aqua fortis*, for Separation of the Silver: And there remained in Gold but 28$\frac{1}{2}$ *grains*, and yet it appeared upon the *Touch*, not fine, but paler than Fine Gold, and deeper than Crown Gold allayed with Silver. So that what remained in it, was neceſſarily of Silver, and it might be eſtimated about twenty three *Kerats* fine, or to hold in *Fine Gold* about twenty ſeven *grains*. What Loſs of *Gold* was upon this Refining with *Antimony*, may be eaſily computed. Firſt, 14$\frac{5}{6}$ *grains* for *Alloy*, being deducted from the firſt Quantity of *Crown Gold*, weighing 178 *grains*, the Remainder i 163$\frac{1}{6}$ *grains*. Then the ſeveral Parcels of fine *Gold* was recovered, and ſeparated from the *Regulus* of *Antimony* and *Gold*, and alſo from the Par cels of *crude Antimony*, reduced to *Regulus*, are to be added together; that is, 30 *grains*, 63 *grains*, 27 *grains*, and 27 *grains*, all which amount t 147 *grains*, which being deducted from the firſt Quantity of 163$\frac{1}{6}$ the Dif ference is 16$\frac{1}{6}$ *grains*, which is more than $\frac{99}{1000}$ or very near a Tenth.

Where and how this Loſs of *Gold* ariſeth, it appears thus. Th Firſt Parcel of the *Antimony*, was charged with 163$\frac{1}{6}$ *Grains* of Fi *Gold*; of which the *Firſt Regulus* weighing 163 *Grains*, (in Proportio to that Piece of it weighing 38$\frac{1}{2}$, and producing upon Refining on th Coppel 30 *grains*) muſt hold 127 *grains* of *Fine Gold*. Then 27 gra of Fine Gold, eſtimated to be contained in the 36 *gr.* ſeparated from this firſt Parcel of *Antimony*, being added to the 127 *gr.* makes 154 *gr.* which is ſhort of 163½ *gr.* by 9½ *gr.* and ſo much was irrecoverably loſt in this Parcel of *Antimony.*

Then the Piece of *Regulus* weighing 124½ *gr.* melted with the ſecond Parcel of *Antimony* (in Proportion to the former piece broke off, weighing 38 *gr.* and upon Refining yielding 30 *gr.* of pure Gold) muſt contain 98 *gr.* of the like Gold; and ſo much this ſecond parcel of *Antimony* muſt be charged with. Towards which the *Regulus* weighting 71 *gr.* being *Refined* produced 63 *gr.* and that Gold, ſeparated from this ſecond Parcel of *Antimony*, weighing 27 *gr.* being added, make 90 *gr.* ſhort of the firſt quantity charged upon this part of the firſt *Regulus* by 7 *gr.*

Some loſs of *Gold* may be upon powdering of the *Regulus*, as alſo by the Papers neceſſarily uſed; but the greateſt loſs was by ſmall Sparks, which continually fly up, while the *Antimony* is in a boiling heat with the Gold many whereof fly over the Pot into the Fire. That theſe ſparks were Gold appeared thus, when many of them ſtuck to an Earthen Cover, and had coloured it of a deep red, *Aqua-fortis* did not fetch off or diſſolve any thing, but *Aqua-Regis* run off it Yellow, like a *Solution* of Gold in the ſame Water.

Some loſs of Gold may alſo be upon the Firing of the *Antimony* with *Tartar* and *Nitre*, which make a Vehement *Conflagration* with abundant Sparkling.

It hath been ſuſpected that ſomewhat of the *Gold* may be diſſipated by the Blaſts upon the *Coppels* in *Refining* it from the *Antimony* remaining in it. But this is not ſo Probable, becauſe when *Refiners* to give their fine *Gold* a higher Colour for *Gilding*, put to it a Third or Fourth part of *Crude Antimony*, or of *Regulus* of *Antimony*, which is a conſtant Practice among ſome of them, and with a great heat and ſtrong Blaſt work it off; in which Operation, in ſome Ounces of *Gold*, they loſe not one *Grain.*

2. There was taken of *Crown-Gold* 141⅓ *gr.* which was melted with 1¾ Ounce of *Antimony* and the *Regulus* weighed 123 *gr.* from this a piece Weighing 30 *gr.* was broken off, and reſerved for *Refining* by it ſelf; the remainder, being 93 *gr.* was melted down again with the ſame *Antimony*, being powdered and put on the top; and thereupon the *Regulus* came forth, weighing 91 *gr.* So that here was no conſiderable loſs. And there is ground to ſuſpect, that it might be upon ſome Accidental difference in the managing, that the *Regulus* did not ſo perfectly ſeparate and ſettle; for in all other Experiments of Melting the ſame *Regulus* again with the ſame *Antimony*, the *Regulus* gained Weight. *With the ſame* Antimony. ib. p. 958.

From this ſecond *Regulus*, a piece was broken off and reſerved for *Refining* apart, weighing 36 *gr.* the remainder being 55 *gr.* was melted down, as the former, and in the ſame *Antimony*. Whereupon the *Regulus* came forth in Weight 72 *gr.* 17 *gr.* being here gained.

The firſt Piece of 30 *gr.* being *Refined* upon the *Coppel*, produced of *Fine-Gold* 24 *gr.* and the ſecond Piece of 36 *gr.* produced 28 *gr.* and the *Regulus* (upon the third Melting) of 27 *gr.* produced 55 *gr.* So that each of the Pieces contained about 4 Fifths of *Gold*, and but one Fifth of *Antimonial* Subſtance in it, yet loſing ſomething of that Proportion at each Melting, tho' the *Regulus* gained Weight; both which are contrary, in repeating the Melting of the *Regulus* with freſh *Antimony*, as in the former Experiments.

The remaining *Antimony* being reduced to a *Regulus* by firing with *Nitre* and *Tartar*, as before, and that *Regulus* exhaled upon the *Coppel* there remained of *Gold* 19 *gr.* This was leſs Fine than that fetched out of the firſt *Antimony* in the former Experiment. But this Impurity was wholly from the *Alloy*; and upon Refining it, firſt with Lead upon the *Coppel* for fetching out the *Copper*, it weighed $17\frac{1}{2}$ *gr.* having loſt $1\frac{1}{2}$ *gr.* and then with the *Aqua-fortis*, after the Melting down with more than the double Weight of Silver, upon which Operation there remained 15 *gr.* and that not Perfect Fine, but retaining ſomewhat of Silver; but finer than Crown Gold allayed with Silver; upon the touch, about 23 *Kerats.*

The loſs of *Gold* is thus computed. From the firſt Quantity of $141\frac{1}{2}$ *gr.* a 12*th.* part or about $11\frac{5}{6}$ *gr.* being deducted for *Alloy*, the Remainder is $129\frac{4}{6}$ *gr.* And the ſeveral Parcels of *fine Gold* produced of the *Regulus*, according to the Account given in particular, being 24 *gr.* 28 *gr.* 55 *gr.* $14\frac{1}{2}$ *gr.* all together make $121\frac{1}{2}$ *gr.* ſhort of the firſt Quantity by $8\frac{1}{6}$ *gr.* or very near one Sixteenth.

By Exhaling the whole Antimony. ib. p 960.

3. A parcel of *Crown-Gold*, weighing $87\frac{1}{2}$ *gr.* was melted down with an Ounce of *Antimony*, and the *Antimony* was Exhaled in the *Crucible* to a *Regulus.* Then the *Antimonial* part of that *Regulus* was *Exhaled* on a Coppel: Whereupon there Remained 84 *gr.* or $1\frac{1}{2}$ *gr.* more than the firſt quantity. This muſt happen for want of a heat ſtrong enough at laſt to Force off all the *Antimonial* Subſtance. Whence afterward, upon Melting in a *Crucible* it came forth 80 *gr.* the $2\frac{1}{2}$. wanting, being leſs than the leaſt part of the Proportion of Coppet, that muſt be in it, according to the uſual *Alloy* of *Crown Gold.* And that there remained Copper in this *Gold* appeared by the Black Complexion of it upon Nealing; as alſo by the loſs upon Working it with Lead on a Coppel; whereupon it came forth only 76 *gr.*

So that *Antimony* in a far greater Proportion, doth not ſo much, as *Lead*, in *Exhaling* or ſeparating *Copper* from *Gold*; if the work be done meerly by *Exhalation*; but doth only retain it with it ſelf, whilſt the *Gold* ſeparates and ſettles in a *Regulus* at the bottom. Neither is it ſo deſtroyed but that it may, in part at leaſt, be united to the *Gold* again.

CXVI. Papers

CXVI. Papers *of leſs general Uſe*, Omitted.

1. Articles of Inquiries concerning Mines; by Mr. *Rob. Boyle.* n.39.p.330

2. Some uſes of *Vaults* and *Cold Conſervatories* in diſcovering Minerals, intimated, by Dr. *Jo. Beale.* n.36.p.1139

3. Several *Coal-Boreings* near *Leeds* in *Yorkſhire*, in the Year 1659, for the Concerns of a private Family, Communicated by Dr. *M. Liſter.* n.450.p.73.

4. Enquiries concerning *Quarries* and *Stones*, and the Ancient way of *Tempering Tools*, for *Cutting Porphyry* and other Hard *Marbles.* n.93.p.6012

5. Several *Curioſities* relating to *Amber*, lately ſent to the *R. Society* from *Philippus Jacobus Hartmannus:* and which are now in their *Repoſitory* at *Greſham College.* n.[illegible].p.49

6. Enquiries about the *Salt-Springs* in *Worceſterſhire* and *Cheſhire*; by Dr. *Beale.* n.20.p.359

7. Queries concerning *Salt Petre.* n.193.p.503

8. The way uſed in the *Mogul's* Dominions, to make *Salt Petre.* Extracted from Mr. *Thevenot's Voyages.* n.6.p.103.

9. Some *Natural Curioſities* ſent the *Royal Society* from *Sicily*; by Dr. *Pet. Silveſter.* n.265.p.632

CXVII. Accounts *of* Books Omitted.

1. The *Mundus Subterraneus* of *Athanaſius Kircher.*

2. *Admirandorum* Foſſilium, *quæ in Tractu* Hildeſheimenſi *reperiuntur, Deſcriptio; Iconibus Illuſtrata; a D.* Frederico Lachmund Hildeſheimi, 1669, in *4to.* n.61.p.107 n.77.p.3016

3. *Lezzioni alla Natura delle* Moffette, *&c.* Diſcourſes concerning the Nature of *Damps*, by *Leonardus Capuanus*, a Member of the *Academy* of the *Inveſtigantes. Naples*, 1683. in *4to.* n.107.p.38

4. *Diſſertationes Medico-Phyſicæ de* Antris Lethiferis; *de Montis* Veſuvii Incendio; *de ſtupendo* Oſſium Coalitu, *de Immani* Hypogaſtrii *ſarcomate, a* Bernardo Connor, *M. D.* Oxon. 1695 in *8vo.* n.219.p.215

5. Franc. Travagini, *ſuper Obſervationibus a ſe factis tempore Ultimorum* Terræ Motuum, *ac potiſſimum* Raguſiani, *Phyſica Diſquiſitio; ſeu, Gyri Terræ Diurni Indicium.* Lugduni Bat. 1669. in *4to.* n.60.p.1084

6. *Hiſtoria & Meteorologia* Incendii Ætnæi, *Anni* 1669. Joh. Alph. Borelli. Regio Julio. 1670. in *4to.* n.75.p.2254

7. *Epiſtola ad* Regiam Societatem Londinenſem, *qua de Nuperis* Terræ-Motibus *diſſeritur, & vera eorum Cauſa eruuntur.* Lond. 1693. in *4to.* n.203.p.893

8. A Philoſophical Eſſay, declaring the probable Cauſes of *Stones* in the greater World, in order to find out the Cauſes and Cure of the *Stone* in the *Kidneys* and *Bladder* of Men, by Dr. *Tho. Sherly. Lond.* in *8vo.* n.84.p.4030

n.23.p.429 9. Hiſtoire des *Jovaux* & des Principales Richeſſes de l'*Orient* & de *l'Occident*, par le Sieur *Chapuzeau*.

n.94.p.4095
n.87.p.5082 10. An Eſſay about the Origin and Vertues of *Gemms*, by the Honourable *R. Boyle*, Eſq. *Lond.* 1672, in 8*vo*. The ſame in Latin.

n.67.p.2039 11. *Eraſmi Bartholini* Experimenta *Cryſtalli Iſlandici Diſ-Diaclaſtici*, quibus Mira & Inſolita *Refractio* detegitur. *Hafniæ.* 1669.

n.23.p.538 12. Hiſtoria *Ambræ Griſeæ*, Auth. *Juſto Klobio*

n.63 p.573 13. Diſcription de la piece de *Ambergris* que la Chamber d'*Amſterdam* a receue des *Indes Orientales*, peſant 182. *Livres :* Avec un petit Traite de ſon Origine & de ſa Vertue, par *Nicolas Chevalier*, a *Amſter.* 1700. in 4*to*.

n.58.p.1202 14. *Jo. Ludov. Ganſii* M. D. *Coralliorum* Hiſtoria. *Francofurti*. 1669. in 12°.

n.61 p.2008 15. The Natural Hiſtory of *Nitre*, or Philoſophical Diſcourſe of the Nature, Generation, Place, and Artificial Extraction of *Nitre*, with its vertues and uſes, by *Will. Clark*, *Lond.* 1670. in 8*vo*.

n.40.p.810 16. Scrutinium Chymicum *Vitrioli*. Auth. *Joh. Georgio Trumphio*. *Jenæ* 1667. in 4*to*.

n.71.p.2162 17. *Theod. Kerkringii* M. D. Commentarius in *Currum Triumphalem Antimonii Baſil. Valentini* a ſe Latinitate donatum. *Amſtelodami*. 1671. in 12°.

n.176.p.1205 18. *Frederici Hoffmanni* Fred. Fil. M. D. Exercitatio Medico-Chymica de *Cinnabari Antimonii Lugd. Bat.* 1685. in 8*vo*.

n.60.p.1085 19. De *Lacte Lunæ* diſſertatio Medica, *Joannis Danielis Majoris*, Ph. & M. D. *Kiloni*. 1667. in 4*to*.

n.66.p.2034 20. *Metallographia* or an Hiſtory of Metals, by *Jo. Webſter*, Practitioner in Phyſick and Chirurgery. *Lond.* 1670. in 4*to*.

n.108.p.187 21. 1. The Firſt Book of the *Art of Metals*, written in *Spaniſh* by *Alonſo Barba*, &c. and *Engliſh'd* by the Right Honourable *Edward* Earl of *Sandwich*, *Lond.* 1674. in 8*vo*.

n.109.p.211 2. The *Second* Book of the *Art of Metals*, wherein is taught the common way of *Refining Silver* by *Quickſilver*, with ſome new Rules added for the better performance of the ſame, Written in *Spaniſh* by *Alonſo Barba*, and *Engliſh'd* by the Right Honourable *Edward* Earl of *Sandwich*, *Lond.* 1674. in 8*vo*

Ph.Col.n.3.p.83 22. Prattica Minerale del Marcheſe *Marco Antonio* della *Fratta*, in *Bologna*, 1678. in 4*to*.

n.107 p.189 23. *Fleta Minor*, or the Laws of Art and Nature in Knowing, Judging, and Aſſaying, Fining, Refining, and Inlarging the Body of confined *Metals*, &c. By Sir *Jo. Pettus*.

n.132.p.814 24. A Touchſtone for Gold and Silver Wares, or a Manual for Goldſmiths, and all other Perſons, whether Buyers or Sellers, or Wearers of any manner of Goldſmiths Work, &c. By *W. B.* of *London*, Goldſmith. in 8*vo*.

n.74.p.2232 25. *Joh. Joachimi Becheri Spirenſis* Med. Doct. Eperimentum Chymicum Novum, quo Artificialis & Inſtantanea *Metallorum generatio* & *Tranſmutatio* ad Oculum Demonſtratur. *Francofurti*. 1671. in 8*vo*.

CHAP. IV.

Magneticks.

I. 1. A conſiderable *Load Stone* was dig'd out of the ground in *Devonſhire*, which weighed 60 *l.* It takes up no great weight, yet it moves a Needle about 9 Foot diſtant. Some part of it was broken off, which being in its proper place, adds much ſtrength; for without that, it moves not much more than 7 Foot.

Loadſtone found in Devonſhire, *By Dr.* Edw. Cotton. n. 23. p. 423.

2. I can aſſure you, that thoſe *Courſes*, *Veins* or *Loads*, where *Loadſtones* are found in the lower parts of *Devonſhire* (either as they lie ſparingly here and there amongſt *Iron Ore*, or as they lie in conſiderable Bodies with it) do all generally run Eaſt and Weſt; which is contrary to the Imagination of thoſe who have thought that the *Loadſtone* gave a *Northerly Direction*, becauſe its Natural Poſition in its Mine was (as they fanſied) North and South.

By Mr. J. Beaumont. Ph. Col. n. 14. p. 8.

II. 1. A Noble Perſon did affirm, That a Needle of a *Sea-Compaſs*, put in a good Iron Mine (which, he ſaid, yielded 23 Pounds of Metal, out of 120 Pounds of *Ore*) was not ſenſibly moved thereby.

2. Intelligent Perſons ſay, That all the Perfection of our Sea-Compaſſes, as yet, conſiſted in this, That the Needle be touched by good *Loadſtones*, and well *Librated*, and that the *Variation* be truly Placed.

Magnetical *Obſervations*; By . . . . n. 23. p. 423.

3. I have often made Tryal with many Needles, Touching them in each *Hemiſphere* of the Stone, with all Variety of ways I could imagine, to find if it were poſſible by that means, to cauſe any of theſe Needles to vary in its Direction; but all of them conform'd to the *Magnetical Meridian*, ſtanding North and South, as other Needles, that were toucht upon the very *Pole* of the Stone.

By Mr. Sellers. n. 23. p. 423. n. 26. p. 478.

All Needles toucht upon different *Loadſtones*, of ſeveral bigneſſes and different Virtue, in all Parts of the World, agree in this *Magnetical* Harmony, that they all give the ſame Directions.

Having ſometimes drawn a Needle only over the Pole of the Stone, within the Sphere of its Vertue, without at all touching the Stone; it hath received the ſame Directive Quality, though not altogether ſo ſtrong as if it had been really toucht upon the Stone it ſelf. I have alſo toucht Needles with faint Strokes, and other Needles with ſtronger; all theſe Needles received the ſame effect upon the Stone, both for Strength and Direction. But the nature of the *Steel*, whereof the Needle is made, and the Temper that is given thereunto, cauſeth different Effects, as to the ſtrength it receiveth from the *Stone*. So that I can infuſe ſuch Vertue into a piece of *Steel*, that it ſhall take up a piece of Iron of 2 Ounces Weight or more; and give alſo to a Needle, the Vertue of conforming to the *Magnetical Meridian*, without the help of a *Loadſtone*, or any thing elſe, that hath received Vertue therefrom.

By Mr. Sam. Colepreſs. n. 27. p. 500.

4. I took a *Loadſtone* unpoliſh'd, which *Attracted* but meanly; and I Heated a Lath-Nail glowing hot, nimbly applying the *North-Pole* of the ſaid *Magnet* to it, which quickly took it up, and held it ſuſpended. Then I caſt the *Stone* into the Fire, and when it was Red Hot, I applyed the *North Pole* to another Lath Nail cold and untouch'd before, which it took up but faintly, yet held it ſuſpended. Two or three Days after, I found that the *Loadſtone* attracted then as ſtrongly, as before it was caſt into the Fire.

The Reſpect of the Needle to a piece of Iron, held Perpendicular, in ſeveral Climates; By [illegible] n. 177. p. 1213.

III. All the way from *England* to 10 *deg. North Latitude*, the *North* Point of the Needle reſpected the upper end of the Iron, and the *South* Point the lower end, very ſtrongly.

Lat. 90. 42′ *N.* and *Meridian* diſtance from the *Lizard* 9°. 32′ *W.* The *S.* point of the Needle did ſtrongly reſpect the Lower end of the Iron, but the *N.* point did not ſo ſtrongly reſpect the upper end, as before. *Lat.* 4°. 33′, *N.* and the *Meridian Diſt.* 5°. 18. *W.* from the *Lizzard*, the *North* point of the Needle begun to decline from the upper end of the Iron, and the *South* point to encline more ſtrongly to the lower end. *Lat.* 0°. 52′ *S.* and the *Meridian Diſt.* 11°. 52′. *W.* from the *Lizard*, the *North* point of the Needle would not reſpect the upper end of the Iron, nor the lower end neither; but the *South* point did ſtill incline to the lower end, though not ſo ſtrongly.

Lat. 5°. 17′ *S.* and *Meridian Diſt.* 15°. 9′. *W.* from the *Lizard*, the *South* point of the Needle would turn to the lower end of the Iron, about two Points, but remove the Iron any farther, and it would fly away from it, and reſpect the Poles again; but it would not reſpect the upper end at all; neither would the *North* point reſpect either, but lay the *Iron Horizontal*, and let the Ends of the *Iron* reſpect the Poles of the World, and the *North* point of the Needle would turn to the *South* End of the *Iron*, and contrarily the *South* point of the Needle would turn to the *North* End of *Iron*; and alter its reſpect to the *Poles* 5 or 6 Points, and no farther; but hold the *Iron Perpendicular*, and put the Middle thereof to the Needle, it would ſtill reſpect the *Poles*.

Lat. 8°. 17′ *S* and *Meridian Diſt.* from the *Lizard* 17°. 35′. *W.* the *North* point of the Needle would not reſpect the upper end of the *Iron*, but rather forſake it, but the *South* point would ſtill ſomething reſpect the lower End, and alter its true Poſition about 2 Points; but take the *Iron* and lay it Aſlope over the Compaſs, ſo that the upper end be towards the *South Pole*, and the lower end to the *North*, and then the *North* point would reſpect the lower end, and follow it; but if you Point the upper end to the *North*, and the lower end to the *South*, the *North* point will forſake it. But if you lay it *Horizontal*, it would do as in the foregoing Obſervations.

Lat. 15°. 00′ *S.* and 20°. 00′ *W*; from the *Lizard*, the *South* point of the *Needle* began to Reſpect the upper end of the Iron, and the *North* point the lower end, and followed it about one point; but lay the Iron *Horizontal*, and the *North* point reſpected the *South* end of the Iron, and contrary wiſe, &c.

Lat. 20. 20′. *S.* and 19°. 20′. *W.* from the *Lizard*, the *South* point of the *Needle* reſpected the upper end of the Iron, and the *North* point the lower end pretty ſtrongly, and followed it 3 or 4 Points; but lay it *Horizontal*, and it would do as before.

Lat. 29°. 25′. and 13°. 10′. *W.* from the *Meridian* of the *Lizard*, the *South* point of the *Needle* reſpected the upper end of the Iron, and the *North* point the lower end ſtrongly.

The Polarity of Iron; By J. C. n. 214 p. 257.

IV. 1. It's known that a Rod of Iron, held *Perpendicular* to the *Horizon*, or *Inclining*, the lower end is its *North Pole*, or attracts the South end of a *Magnetick Needle*; and that the ſame end held upwards, becomes a South *Pole*, *ſc.* attracts the North end of the Needle, and repels the South end.

I call that a *Mutable Pole*, which may be North or South, as you hold it; and a *Fixt Pole* that which does not Change however you hold it.

2. The *Species* of the Pole, whether North or South, may be found by paſſing the Iron Rod through Cork or Wood, and then leaving it to ſwim on Water, it will turn to its proper *Pole*: But this way is ſlow and not nice. A better way to try, for Inſtance a *North Pole*, is to hold the Iron *Perpendicular* to the *Horizon*, and to try whether being held under the *North* end of the *Needle*, it attracts it. But a yet better way is to try whether the upper End of the Rod attracts the South end of the *Needle*: for *Attraction* is more ſenſible than *Expulſion*.

3 A *Fixt North Pole* may be made with all the Ways and Rods that you can make a *Fixt South Pole*; but not *vice verſa*, for there are many Caſes wherein you can make a *Fixt North Pole*, but not a *Fixt South Pole*: And whatever way you get a *Fixt South Pole*, 'tis weaker than a *Fixt North Pole* made the ſame way. Applying a *Needle* to an Erect Bar, beginning at the top, and ſo down, the *Needle* turns not at the Middle, but nearer. Of ſome Rods you cannot make a Fixt South primarily, yet you may conſequentially, ſo you may make one End a *Fixt North Pole*, and then the other end of thoſe Rods may, without more to do, become a *Fixt North Pole*. But this does not always hold, for the one may be a *Fixt North Pole*, and the other may be a Mutable Pole.

4. Fire deſtroys all *Fixt Poles*, *ſc.* whether made by the *Magnet*, or otherways, but it increaſes, or rather leſs hinders that *Magnetiſm*, which proceeds from the Earth; *ſc.* a Wire or Rod of Iron heated at one end, that end is a Mutable Pole, but more vigorous while Hot than Cold. The Vigour of Mutable Poles is more in great than little Rods; but 'tis otherwiſe in *Fixt Poles*.

5. Heat the End of a Rod of Iron Red Hot (or Heat all the Rod) and Cool that Ignited end *Northward*, it will be a *Fixt North Pole*; if cooled South it becomes a Fixt South Pole. This ſay *Gilbert* and others from Experience: But I ſay this holds but in ſome caſes; *ſc.* if the Rod is ſhort, you cannot make a *Fixt Pole* that way. Take a Round Wire whoſe Diameter is $\frac{1}{7}$ Inch, and length 10 Inches, you cannot produce a *Fixt Pole* by *Ignition*, but if this Wire were longer, as ſuppoſe 30 Inches long, or never ſo much longer,

'tis capable of a *Fixt Pole* by *Ignition*. Again, take a round Rod 30 Inches long, and 1 Inch Diameter, this Rod is not capable of a *Fixt Pole* at that length, though the leſſer was capable at that length. And ſo my Experiments give me reaſon to think, that there is no Rod nor Bar of Iron ever ſo thick, but which if it had length enough, would be capable of a *Fixt Pole* by bare *Ignition*; for of that I only ſpeak in this Paragraph: And there is no Rod ever ſo ſhort, but which if you make it ſufficiently thin, is capable of a *Fixt Pole*. So when in a Rod I could not obtain a *Fixt Pole* at 21 Inches length in that thickneſs, I could, by making the Rod thinner, produce a *Fixt Pole* even in the length of one Inch and leſs, and the *Pole* ſhould be of what kind I pleaſed. The *Terminus*, or neceſſary length, for every thickneſs increaſes more than you would be apt to think.

6. Heat a Rod, or its End Red Hot, and throughly Cool this end downwards or towards the *Nadir*, it will have ſomewhat more *Magnetiſm* than if Cooled *Horizontally* towards the *North*. But the better way is to Cool it a little inclining towards the *North*. I cannot find that multiplicity of *Ignitions* does produce more *Magnetiſm* than one good *Ignition*; but it muſt be throughly *Ignited*. Nor can I find by many Experiments, what Quenching in Water ſignifies to the producing or hindring *Magnetiſm*; but many *Ignitions* may accidentally promote it by Purifying the Iron.

7. Dr. *Power* ſays, that if we hold a Rod Northward, and Hammer in that Poſition the North end, that will become a *North Pole*, *i. e.* a *Fixt North Pole*: contrarily if you *Hammer* the *South* end. But this is true (as I ſaid before of *Ignitions*) only in Rods of a certain length and thickneſs.

8. What is ſaid of Hammering is to be underſtood of Filing, Grinding, Drilling, Sawing: Yea, a ſoft Rubbing, provided it is long, will produce *Fixt Poles*. The more Heavy the Blows are, *cæteris paribus*, the *Magnetiſm* is more. I ſay *cæteris paribus*, as when the Blows be not ſo heavy in either Caſe as to flat; for flatting the Iron produces more *Magnetiſm*, though other things don't vary. A few hard Blows will produce as much *Magnetiſm* as many, yet a ſoft Blow, may produce but little *Magnetiſm*. The utmoſt *Magnetiſm* that I could produce in Ordinary Rods this way, did not exceed that which an Ordinary Loadſtone would have infuſed.

9. Beating many Rods Northward, whoſe lengths I knew ſufficient, I never failed of producing a *Fixt North Pole*; but Hammering the ſame or like Rod Southward, I found that I could not produce a *Fixt South Pole*, only a *Mutable Pole*; nay Hammering one full South, I produced a *Fixed North Pole*. Then I thought the Reaſon might be, that the Hammer'd South end on the Anvil was a little lower than the end which I held in my Hand: Then I held the end higher, and ſo Hammering it South upwards, I never failed producing *Fixt South Poles* in proper Rods.

10. Old Drills and Punches are *Fixt North Poles*, becauſe almoſt conſtantly uſed downwards: But new Drills are either Mutable Poles, or weak North Poles. When I ſay a New Drill, I don't mean one made on the Spot, for that is probably a *North Pole*, becauſe quench'd downwards in Water; but then ſuch *Polarity* made by bare *Ignition*, is a Weak Pole,

and ſoon decays and turns to a *Mutable Pole*: But I mean a *Drill*, which tho' never or little Uſed, yet has been made ſome Days or Weeks. *Drill* with this *Southward Horizontally*, and 'tis a Chance if you produce a fixt *South Pole*, but much leſs if you drill *South* downwards: But if you drill *South* upwards, you may make it a fixt *South Pole*.

11. The ſtronger the *Polarity* is, the longer it will laſt. A Weak fixt Pole may degenerate into a mutable Pole in a Day's Time; yea I have known it in a few Minutes, while expoſed to the Air, and held in a Poſition contrary to its Pole; On the contrary, we find *Needles* touched with good *Loadſtones*, hold that Virtue a great while, if kept from Air, and in a *Meridian* Site.

12. The *Loadſtone* it ſelf will not make a fixt Pole of any Iron; it muſt have a proper Length if 'tis thick, or if 'tis ſhort, it muſt have a ſufficient Thinneſs. So ordinary or weak *Loadſtones* cannot fix a Pole in a thick ſhort Key, which yet they will do in a little Key. So in a ſhort thick Iron Tapering, a *Loadſtone* may fix a Pole in the little End, when it cannot in the great End.

13. When *Ignition*, *Hammering*, or a *Load-ſtone* cannot make fixt Poles, it muſt not be thought that it can do abſolutely Nothing on ſuch Rods; for even then it may be found, that there's an Effect of *Magnetiſm* in them Diſcernable enough otherwiſe, though not enough to make fixt Poles.

14. When you have the due Length for making of a fixt Pole, you will find the making one a fixt North, will conſequently render the other a fixt South Pole: But if keeping the ſame Diameter of this Rod, you increaſe it's Length enough, the making one End a *fixt North Pole*, will not neceſſarily make the other a *fixt South Pole*, but leave it a mutable Pole. So if you by a like primary Operation make the ſecond End a fixt Pole, the firſt End will loſe its *Fixity*, and become *mutable*.

I ſay there's a certain Length ſuited to every Thickneſs of *Iron*, to leave one End *mutable*, while the other is *fixt*, and the thicker the Iron is, the greater is the Length.

15. If you farther increaſe the Length of the ſame Rod, you will attain ſuch Length, that when you have *fixed* a Pole on one end, and then go to *fix* the other end, the *Fixity* of the Firſt will not be deſtroyed, and that end become *mutable* as before; but the *Fixity* of the Firſt End will remain, and ſo you make both Ends two *fixt North Poles*, or 2 fixt *South Poles*. I ſay, the ſhorteſt Length, (for there's no *Terminus* of the greateſt Length) for this is more in thick than in thin Iron.

16. The aforeſaid Lengths are leſs, according to the Strength of *Magnetiſm*; *ſc. Ignition* requires a greater length than when a Rod is actuated by a *Loadſtone*, and a Rod touched with a ſtrong *Loadſtone* requires leſs Length than one touch'd with a Weak one.

2. 1. I cauſed 6 or 7 ſeveral *Drills* to be made before my Face, and the *Bit* or *Point* of every one became a *North Pole*, only by *hardening*, before they ever came to be workt, either in Iron or any other Matter, ſo that I cannot ſup-

By Mr. Ballard. n. 245. p. 417.

poſe thoſe found in a Shop to have gotten their Polarity ſo much from their Afteruſe as from their Firſt Make.

2. That pieces of plain Iron, in ſhape like *Drills*, (that is ſomething long and ſmall) do always change their *Poles* as they are inverted, the end downwards being ever the N. Pole, I find not always true, for though it hold generally in ſuch ſmall Pieces, and always (as far as I can yet find) in pieces of any Bulk, as large Hammers, Anvils, Andirons, Bars of Windows, *&c.* yet I found ſeveral ſmall pieces of *Steel*, ſuch as the *Drills* are made of, to have *fixed Poles*, one end *North*, the other *South*, in whatever Poſtures I held them. Some of theſe were very vigorous in ſuch their Polarity, others ſhew'd plainly a Tendency to ſuch a Pole, rather than the other, yet ſo faintly, that it applied contrary to their Inclination, (that is at the upper End, if it affected to draw the *South*, or the lower End, if the *North*;) They cauſed the Needle to ſtand in *Æquilibrio*, Eaſt and Weſt; the particular Inclination of one End ſeeming, in ſome Pieces, quite to conquer; in others, quite to hinder that more general Polarity they both acquire, by being either upward or downward. Yet this ſeems only to be found in ſmall Stems of Iron; the being either upward or downward always prevailing in pieces of greater Bulk.

3. I took my Knife, which had been toucht a *Quarter* of a *Year* or more before, and profering it to the *Needle*, it drew the *North Pole*; which happen'd right for my purpoſe. I whetted it briskly on a dry dirty Threſhold, and being thin, it became very hot towards the Point, the Edge being whet away to a *Wire*, as they term it, I ſtruck the very top, and back towards the Top againſt the Ground, as I had done the Sides, to deſtroy and rub off, if I could all its former Polarity, which was *Southward*, then offering it again to the *Needle*, it drew the *South End*, and was quite changed. To confirm the thing, I toucht the ſame Knife again with the *North Pole* of my *Loadſtone*, and it drew vigorouſly the *North End* of the *Needle*. I whetted it again ſtrongly in the ſame Manner, and it changed again. This I repeated 5 or 6 Times, and it ſtill changed by whetting, eſpecially on the ſides towards the Top of the Knife, the very Top and Back, which could not be whet to ſo great an Heat, retaining ſtill ſome Affection for that Pole the *Loadſtone* had inclined them to. This I tried with a Knife of a thicker Blade; but I could not with my Hand whet it to that Heat, as to have the ſame Effect wrought upon, as my own; though I uſed ſuch Force as at laſt to break it in two.

4. I ſuppoſe that bare *Drilling* might be able to give a Polarity to a *Drill*, if it could be made indifferent, as well as *Filing* does, if the *Drill* be uſed ſo briskly as to be made as hot as the *File* makes the Iron. And tho' a *South Pole* given by the *Magnet* cannot be taken off by the Heat of a brisk Motion, as that of *Drilling*, which yet by the Experiment of my Knife ſeems to be contradicted; yet perhaps the Heat may be great enough to produce a *Polarity* in an indifferent Piece of Iron, as may be done in little indifferent *Drill-like* Pieces of *Steel*, by *Filing*.

5. Two Degrees to the Northward of the Line, the North Point of the *Needle* did incline 8 Degrees downwards, but as we went to Southward, it was inclined above 48 Degrees upward.

a The Declination of the *Needle*, obſerved by Mr. Ja. Cunningham, n. 264. p. 577.

VI. 1. *An.* 1666. *Jun.* 13. In *Rownham* Meadows near *Briſtol*, by the Water ſide, Capt. *Sturmy* took the following Obſervations,

Magnetical Variations, near Briſtol, by Capt. Sa. Sturmy, n. 37. p. 726.

☼ *Alt.*	*Magnetick Azimuth.*	☼ *Azim.*	*Variation Weſterly.*
44 20′	72°. 00′	70°. 38′	1°. 22′
39. 30	80. 00	78. 24	1. 36
31. 50	90. 00	88. 26	1. 34
27 2	95. 00	93. 36	1. 24
23. 20	103. 00	101. 23	1. 23

In this Table, he notes the greateſt Difference to be 14′. and taking the Mean for the true Variation, he concludes it then and there, to be juſt 1°. 27′. He obſerved again in the ſame Day of the next Year, *viz.* *June* 13. 1667. and then he found the Variation encreaſed about 6′ Weſterly.

2. *An.* 1630. I traced 3 different *Meridian* Lines in ſeveral places of *Paris*, and found, that the *Needle* declined 4½ deg *North-Eaſt*, which having publiſh'd and made known here to the Curious, and to *Artiſts*, ſome of whom counted 9 or 10 *deg.* according to the Tradition and Writings of *Orontius Fineus*, and *Caſtle Franc*; others, 11½ *deg.* following *Sennertus* and *Offuſius*; all at firſt rejected my Obſervation, and as commonly new things meet with Obſtacles and Contradictions, before they are eſtabliſht, thoſe that could not contradict what they ſaw, pretended that this variety did perhaps proceed from the greater or leſſer *Vigour* in the *Loadſtones* employed to touch with, or from thence, that the *Needles* had been toucht nearer to or farther from their *Poles*.

At Paris, by M. Petit. n. 28. p. 527.

To remove the Objections and to try another Quality which *Gilbert* had aſſigned to *Terella*'s, I cauſed a *Magnet* to be turned with the Powder of *Emery*, till it became a ſpherical half Inch in *Diameter*, its 3 Centers of *Magnitude*, *Gravity* and *Strength* being the ſame with ſo much Juſtneſs, that after I had exactly found the two Poles of this Stone, I cauſed 2 ſmall Holes to be made therein, to ſupport it by two Points of *Needles*, as by two Pivots; which having put in a *Meridian* of Braſs, and ſuſpended the Ball betwixt them like a little Globe, it was ſo eaſily moveable, that I made it turn every way with a Blaſt only of my Mouth, and it ſtopped indifferently, now in one, then in another Place, not any ſide of it prevailing.

This *Stone*, being thus prepared without any Defect in Vertue or Figure, uniform, homogeneous, equilibrated, was adjuſted on its *Meridian*, and an *Horizon*, and ſo placed on its *Meridian* Line, that the Poles thereof anſwered to the Poles of the Heavens. The Succeſs was that it had not any Motion at all, whence I thought the Propoſition of *Gilbert*, that ſuch a Stone ſo poſited, would turn round in 24 Hours, was ſufficiently refuted.

This *Stone* together with others (whereof the Poles were well mark'd) ſerved me alſo to find out, whether the *Needles* touched in different Places, nearer to or farther from the Poles, had different Declinations. Which having tried frequently, I found no Difference at all in the Declination of the *Needles*, but all of them declined then from the *Meridian* $4\frac{1}{2}$ *deg*. from the *North-Eaſtward*, I alſo found it to be the ſame in many Places, from *Breſt* in *Brittany* to the *Valtoline* amongſt the *Alps*. I believed at firſt, that the Ancients had ill obſerved the Variation: but I was ſoon undeceived of this Error, by the Obſervations in *Enlgand*, of Mr. *Burrows*, *An.* 1580. of Mr. *Gunter*, *An.* 1612. and of Mr. *Gellibrand*, *An.* 1633. which did aſſure me, that thoſe *Declinations* were not conſtant.

And that I might be convinced by my ſelf, in *June An.* 1660, after I had very exactly traced a *Meridian* by many *Azimuths*, before and after Noon, with a *Braſs Quadrant* of 6 Foot Diameter, and applied good Needles upon it; the one of 7. the other of 10 Inches long, I found that they declined but one Degree, or thereabout: And the laſt Year (1666) I found no more but 10 Minutes on the ſame *Meridian*. And methinks that the *Declination* this Year (1667) is ſtill leſs, but yet ſome Minutes towards the Eaſt, at leaſt at *Paris*. But I doubt not but in 12 or 15 Years the Declination will be $1\frac{1}{2}$ *deg*. *North-weſt*. As I have prognoſticated by my *Hypotheſis*, which maketh the Declination to vary a Degree every 7 or 8 Years.

At Rome, by M. Adr. Auzout, n. 58. p. 1184.

3. *An.* 1670. M. *Adrian Auzout* made the following Obſervation here at *Rome*, on many meridian Lines, with a *Needle* about 6 Inches long, and on all the Lines it was ſeen to decline ſomewhat more than 2 *deg*. Weſtward, and on ſome near $2\frac{1}{2}$ *Degrees*. But by the Obſervations here made formerly, it appears, that the Needle hath declined Eaſtward to 8 Degrees, and hath afterwards been diminiſhing, until it comes to the other Part, where we find it at preſent.

It ſeems not, that this Difference of 10 *deg*. and more, can be attributed to the Change of the Pole of the Earth, or to the *Magnet*, or to the *Iron*, that are found in certain Places, becauſe there is but little *Loadſtone*, and M. *Auzout* affirms, that the Mines which he hath ſeen, make no Impreſſion at all on the Needle, ſo that 'tis difficult to hit the true Cauſe of ſuch a Variation: Yet however, if the Direction of the *Magnet*, and of the *Needle touched* by it, depends upon the Flux of a certain Matter, paſſing thro' the whole Earth, or the exterior Parts of it, ſtrait along the *Axis*, it may be ſaid, that it proceeds from Changes made in the ſaid *Flux*, which ſuppoſing the Inequalities of the Earth, and the Alterations made continually therein, as well artificial by Excavations, and ſuch like other works, as natural, by Corroſions, cauſed by Fire and Water, or by the Generation of *Metals* and *Stones*, beſides the various changes, we cannot think of, by reaſon of the little knowledge we have of ſo vaſt a Body as the *Earth*, cannot but in progreſs of time, change its ſituation. The Inequalities of the Earth may in time occaſion ſome bending in the *Current* of this *Magnetick* Matter, and make it change its bed and Channel; whence it comes to paſs, that the *Needle* changeth its Direction according as the *Current* changeth which directs it. And if it ſhould be ſo, there would be no Hopes of finding a regular *Hypotheſis* for that Change; for as much as it would depend upon Cauſes that have no Regularity at all in them, as moſt of the Mutations of Nature are.

At Dantzick by Mr. Hevelius, n. 64. p. 2059.

4. *An.* 1642 I obſerved the *Declination* of the *Magnet* here at *Dantzick*, as did M. *Linnemannus* about the ſame time at *Koningsberg*, and we both found the *Magnetick Needle* at that time to *decline* from the *North* 3° 5′ *weſtw*. But now (*Jun.* 22. 1670. *St. n.*) it is far otherwiſe, for it declines at preſent, as I have very carefully obſerved, 7°. 20′. to the ſame Quarter; ſo that in the ſpace of 28 *Years*, that *Declination* is increaſed 4°. 15′. In the Year 1628, if I remember aright, I found it near *one degree weſtward*; which *Declination* was affirmed by the learned *Petrus Crugerus* (once my worthy *Preceptor*) to have been about the Beginning of this Age, or the End of the next foregoing 8°. 30′. *Eaſtward*. Hence it appears, that this *Declination* of the *Loadſtone* doth here, at *Dantzick*, encreaſe each Year to 9′. 6″. which is ſufficiently confirmed by the Obſervations made at *Lime-houſe*, near *London*, by thoſe 3 famous *Engliſhmen*, *Burrows*, *Gunter*, and *Gellibrand*. Of whom the Firſt found the Declination *A.* 1580 to be 11°. 16′. the *Second*, 5°. 36′. 30″. *An.* 1622. ; the *Third*, 4°. 3′. 30″. *A.* 1634.

I cannot yet deviſe any Cauſe of thoſe Appearances, except we impute them to a kind of Libration in the Motion of the Earth, and the Variation of the *Meridian*.

At Nuremberg in Germany, by Joh. Chr. Sturmius, Ph. Col. n. 1. p. 8.

5. The laſt Summer 1680, I was preſent with Dr. *Geo. Volcamier*, at *Nuremberg*, while he was making ſome Obſervations and Tryals, with his *Magnetical Needle*. He repeated the Tryals ſeveral Days one after another, and with various ways of Examination, but ſtill in every of them, with the ſame ſucceſs, he moſt certainly found, that the North End of the Magnetical *Needle*, (which the former Age always reported to us, to vary from the North, and to direct or point more towards the Eaſt, by ſeveral degrees) did now decline towards the Weſt near 5 Degrees.

M. G. C. Eimmart, n. 178. p. 1253.

An. 1685. Sub Initium Menſis *Auguſti*, de certitudine *Meridianarum* omni qua fieri potuit Cura ex Circumſpectione Securi redditi, applicatis variis *Pyxidibus Magneticis*, tam iis vetuſtioribus, quæ ante Quinquennium huic Uſui adhibebantur, quam aliis Recentioribus pluribus, mediocris quidem Longitudinis, quarum maxima *Semiſſem Pedis* non excedebant, ſed Gracilioribus & Vivacibus, animadvertebamus, quod mirum, Declinationem Acus a Priſtina nec in uno minuto diſcrepare, ſed in quavis *Meridiana* exacte cum priori convenire, ad *Occaſ. Stil.* 5°. 1′. An autem interea temporis

ulterius proceſſerit, aut nunc in Situ Retrogrado ejus Deviatio deprehenſa fuerit, quod certe caſu eveniſſe potuiſſet, non liquet, cum nec temere iſtud ſtatuere, quin in eam Sententiam, quod *Stationarius* (procul dubio *Circularis Motus*) in eodem puncto permanſerit, proniusabire velimus.

On the Coaſt of *Guinea*, by Mr. *Heathcot*, n. 158. p. 578.

7. *An.* 1683. The Magnetical Variation here at *Cabo Corſe Caſtle*, was 3°. 49′ from the North to the Weſtward.

Magnetical Variations predicted, by Mr. Hen. Bond, n. 40. p. 789.

VII. Mr. *Henry Bond*, having entertained an Hypotheſis of the variations of the Needle, hath (for the Examination of it) calculated the following Table.

Years	*Variation Weſt.*	*Years*	*Variation Weſt.*	*Years*	*Variation Weſt.*	*Years*	*Variation Weſt.*
1663	1°.—56′	1701	7°.—19′	1706	8°.—1′	1711	8—41
1670	2—18	1702	7—28	1707	8—9	1712	8—49
1680	4—00	1703	7—36	1708	8—17	1713	8—56
1690	5—39	1704	7—45	1709	8—25	1714	9—4
1700	7—10	1705	7—53	1710	8—33	1715	9—11

A Theory of the Magnetical Variation, by Mr. Edm Halley, n. 148. p. 208.

VIII. Before I proceed to the Theory of the *Variation* of the Magnetical Compaſs, it is neceſſary to lay down the Grounds upon which I raiſe my Concluſions: and at once to give a Synopſis of thoſe *Variations* which I have Reaſon to look upon as ſure, being moſtly the Obſervations of Perſons of good Skill and Integrity.

Names of Places.	*Long. from London*	*Latitude.*	*An. Dom.*	*Variation obſerved.*
London	0° 0′	51° 32′ N	1580	11° 15′ E
			1622	6 0 E
			1634	4 5 E
			1672	2 30 W
			1683	4 30 W
Paris	2 25 E	48 51 N	1640	3 00 E
			1666	0 00
			1681	2 30 W
Uraniburg	13 00 E	55 54 N	1672	2 35 W
Copenhagen	12 53 E	55 41 N	1649	1 30 E
			1672	3 35 W
Dantzick	19 00 E	54 23 N	1679	7 00 W
Mompelier	4 00 E	43 37 N	1674	1 10 W
Breſt	4 25 W	48 23 N	1680	1 45 W

Rome	12 00 E	41 50 N	1681	5 00 W
Bayonne	1 20 W	43 30 N	1680	1 20 W
Hudſon's Bay	79 40 W	51 00 N	1668	19 15 W
In *Hudſon's Streights.*	57 00 W	61 00 N	1668	29 30 W
In *Baffin's Bay at Sir Tho. Smith's* (*Sound*	80 00 W	78 00 N	1616	57 00 W
At Sea	57 00 W	38 40 N	1682	7 30 W
At Sea	31 30 W	43 50 N	1682	5 30 W
At Sea	42 00 W	21 00 N	1678	0 40 E
Cape St. *Auguſtine* off *Braſile*	35 30 W	28 00 S	1670	5 30 E
Cape *Frio*	41 10 W	22 40 S	1670	12 10 E
At Sea off of the Mouth of the River of *Plate.*	53 00 W	39 30 S	1670	20 30 E
At the *Eaſt* Entrance of *Magellan Streights.*	68 00 W	52 30 S	1670	17 00 E
At the *Weſt* Entrance of the *Magellan Streights.*	75 00 W	53 00 S	1670	14 10 E
Baldivia	73 00 W	40 00 S	1670	8 10 E
At Cape d'*Agulhas*	16 30 E	34 50 S	1622	2 00 W
			1675	8 00 W
At Sea	1 00 E	34 30 S	1675	0 00
At Sea	20 00 W	34 00 S	1675	10 30 E
At Sea.	32 00 W	24 00 S	1675	10 30 E
At S. *Helena*	6 30 W	16 00 S	1677	0 40 E
At *Aſcenſion*	14 30 W	7 50 S	1678	1 00 E
At *Johanna*	44 00 E	12 15 S	1675	19 30 W
At *Mambaſa*	40 00 E	4 00 S	1675	16 00 W
At *Zocatra.*	56 00 E	12 30 N	1674	17 00 W
At *Aden*, at the M. of the R. *Sea*	47 30 E	13 00 N	1674	15 00 W
At *Diego Roiz*	61 00 E	20 00 S	1676	20 30 W
At Sea	64 30 E	0 00 S	1676	15 30 W
At Sea.	55 00 E	27 00 S	1676	24 00 W
At *Bombay*	72 30 E	19 00 N	1676	12 00 W
At *Cape Comorin*	76 00 E	8 15 N	1680	8 48 W
At *Ballaſore*	87 00 E	21 30 N	1680	8 30 W
At *Fort St. George*	80 00 E	13 15 N	1680	8 10 W
At the *Weſt Point* of *Java*	104 00 E	6 40 S	1676	3 10 W
At Sea	58 00 E	39 00 S	1677	27 30 W
At the Iſle of *St. Paul.*	72 00 E	38 00 S	1677	23 30 W
At *Van Diemens Land*	142 00 E	42 25 S	1642	0 00
At *New Zealand*	170 00 E	40 50 S	1642	9 00 E
At 3 *Kings Iſle in New Zealand*	169 30 E	34 35 S	1642	8 40 E
At the Iſle Roterdam in the *S. Sea*	84 00 E	20 15 S	1642	6 20 E
On the Coaſt of *New Guinea*	149 00 E	4 30 S	1643	8 45 E
At the *Weſt point* of *New Guinea*	126 00 E	0 26 S	1643	5 30 E

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By this Table it appears,

Firſt, That in all *Europe* the Variation at this Time is *Weſt*, and more in the Eaſtern Parts thereof than the Weſtern; as likewiſe that it ſeems throughout to be upon the Increaſe that Way.

2. That on the Coaſt of *America*, about *Virginia*, *New England*, and *Newfoundland*, the Variation is likewiſe weſterly, and that it increaſes all the way as you go *Northerly* along the Coaſt, ſo as to be above 20 Degrees at *Newfoundland*, nearly 30 deg. in *Hudſon's Streights*, and not leſs than 57 *deg* in *Baffin's Bay*; alſo that as you ſail *Eaſtward* from this Coaſt, the *Variation* diminiſhes. From theſe two it is a *Legitimate Corollary*, That ſomewhere between *Europe* and the North Part of *America*, there ought to be an Eaſterly Variation, or at leaſt, no Weſterly; and ſo I conjecture its about the Eaſtermoſt of the *Tercera* Iſlands.

3. That on the Coaſt of *Braſil* there is *Eaſt-variation*, which increaſes very notably as you go to the *Southward*, ſo as to be 12 *deg*. at Cape *Frio*, and overagainſt the River of *Plate* 20½ deg. and from thence, ſailing *South-weſterly* to the *Straits* of *Magellan*, it decreaſes to 17 *deg*. and at the *Weſt* Entrance it is but 14 Degrees.

4. That to the *Eaſtward* of *Braſil* properly ſo called, this *Eaſterly Variation* decreaſes, ſo as to be very little at St. *Helena* and *Aſcenſion*; and to be quite gone, and the Compaſs to point true about 18 deg. of *Longitude*, *Weſt* from the Cape of *Good Hope*.

5. That to the Eaſtward of the aforeſaid Places, a *Weſtward Variation* begins, which reigns in the whole *Indian Sea*, and ariſes to no leſs than 18 *deg*. under the *Æquator* it ſelf about the Meridian of the Northern part of *Madagaſcar*, and near the ſame Meridian, but in 39 *deg*. *South Latitude*, it is found full 27½ deg. from thence Eaſterly, the Weſt Variation decreaſes, ſo as to be but little more than 8 *deg*. at Cape *Comorin*, and then 3 deg. upon the Coaſt of *Java*, and to be quite extinct about the *Molucca* Iſlands, as alſo a little to the Weſtwards of *Van Diemen's Land*, found out by the *Dutch* in 1642.

6. That to the *Eaſtward* of the *Molucca*'s and *Van Diemen's Land* in *South Lat*. there ariſes another *Eaſterly Variation*, which ſeems not ſo great as the former, nor of ſo large Extent; for that at the *Iſland Roterdam* it is ſenſibly leſs than upon the *Eaſt-Coaſt* of *New Guinea*, and at the Rate it decreaſes, it may well be ſuppoſed, that about 20 *deg*. farther *Eaſt*, or 25 *deg*. *Eaſt Long*. from *London*, in the *Latitude* of 20 *deg*. *South*, a *Weſterly Variation* begins.

7. That the *Variations* obſerved by the Hon. Sir *John Narborough*, at *Baldivia*, and at the *Weſt Entrance* of the *Straits* of *Magellan*, do plainly ſhew, that that *Eaſt Variation* noted in our 3*d*. Remark is decreaſing apace, and that it cannot reaſonably extend many Degrees into the *South-Sea*, from the Coaſt of *Peru* and *Chili*, leaving Room for a ſmall Weſterly Variation, in that Tract of the unknown World, that lies in the Midway between *Chili* and *New-Zeland*, and between *Hounds Iſland* and *Peru*.

8. That in ſailing *North-weſt*, from St. *Helena*, by *Aſcenſion*, as far as the *Æquator*, the *Variation* continues very ſmall *Eaſt*, and as it were conſtantly

the ſame: So that in this part of the World, the Courſe wherein there is no *Variation*, is evidently no *Meridian*, but rather *Northweſt*.

9. That the Entrance of *Hudſon's Streights* and the Mouth of the *River of Plate*, being nearly under the ſame *Meridian*, at the one place the *Needle Varies* 29½ *deg.* to the *Weſt*, at the other 20½ *deg.* to the *Eaſt*. This plainly demonſtrates the Impoſſibility of reconciling theſe *Variations* by the Theory of *Bond*; which is by *Two Magnetical Poles and an Axis, Inclined to the Axis of the Earth*; from whence it would follow that under the ſame *Meridian*, the *Variation* ſhould be in all Places, the ſame way.

Theſe things being premiſed, may ſerve as a ſure Foundation for this *Theory*, That *the whole Globe of the Earth is one great* Magnet. *having* 4. Magnetical Poles, *or Points of Attraction, near each* Pole *of the Æquator* 2, and that *in thoſe Parts of the World which lie near adjacent to any one of theſe* Magnetical Poles, *the* Needle *is governed thereby*; *the neareſt* Pole *being always Predominant over the more* Remote. The parts of the Earth wherein theſe *Magnetical Poles* lie, cannot as yet be exactly determined for want of ſufficient *Data* to proceed *Geometrically*: But, as near as Conjecture can reach, I reckon that the *Pole* which is at preſent neareſt to us, lies in or near the *Meridian* of the *Lands End* of *England*, and not above 7 *deg.* from the *Pole Artick*. By this Pole the *Variations* in all *Europe*, and *Tartary*, and the *North Sea*, are principally governed; tho' with regard to the other *Northern Pole*, whoſe Situation is in a *Meridian* paſſing about the middle of *California*, and about 15 *gr.* from the *North Pole* of the World. To this the *Needle* has chiefly reſpect in all the *North America*, and in the two *Oceans* on either ſide thereof, from the *Azores* Weſtwards to *Japan*, and farther. The two *Southern Poles* are rather farther diſtant from the *South Pole* of the World. The one about 16 *deg.* therefrom, is in a *Merid.* ſome 20 *deg.* to the Weſtward of *Magellan's Streights*, or 95 *deg. Weſt* from *London*; this Commands the Needle in all the *South America*, in the *Pacifick Sea*, and the greateſt part of the *Æthiopick Ocean*. The 4*th* and laſt Pole ſeems to have the greateſt Power and largeſt Dominions of all, as it is the moſt remote from the Pole of the World, being little leſs than 20 *deg.* diſtant therefrom, in the *Meridian*, which paſſes through *Hollandia nova*, and the Iſland *Celebes* about 120 *deg. Eaſt* from *London*. This Pole is Predominant in the *South* part of *Africa*, in *Arabia*, and the *Red Sea*, in *Perſia*, *India*, and its Iſlands, and all over the *Indian Sea* from the Cape of *Good Hope* Eaſtwards to the middle of the great *South Sea* that divides *Aſia* from *America*. This ſeems to be the preſent Diſpoſition of the *Magnetical Vertue* throughout the whole Globe of the Earth.

By this *Hypotheſis* it is Plain that (our *European North Pole*, being in the *Meridian* of the *Lands Ends* of *England*) all Places more *Eaſterly* than that will have it on the *Weſt* ſide of the *Meridian*; and conſequently the Needle, reſpecting it with its Northern Point, will have a *Weſterly Variation*, which will ſtill be greater as you go to the *Eaſtwards*, till you come to ſome *Meridian* of *Ruſſia*, where 'twill be greateſt, and from thence Decreaſe again. Thus at *Breſt* the *Variation* is but 1¾ *deg.* at *London*, 4½ *deg.* but at *Dantzick*, 7 *deg. Weſt*. To the *Weſtward* of the *Meridian* of the *Lands End*, the Needle ought to have an Eaſterly Variation, were it not that (by approaching the *American* Northern Pole, which lies on the Weſt ſide of the Meridian, and ſeems to be of greater Force than this other) the Needle is drawn thereby Weſtwards, ſo as to Counterbalance the Direction given by the *European* Pole, and to make a ſmall Weſt Variation in the Meridian of the Lands End it ſelf. Yet I ſuppoſe that about the Meridian of the Iſle *Tercera*, our neareſt Pole may ſo far prevail as to give the Needle a little turn to the Eaſt, though but for a very ſmall ſpace, the Counterbalance of thoſe two Poles, permiting no conſiderable Variation in all the Eaſtern Parts of the *Atlantick Ocean*; nor upon the Weſt Coaſts of *England* and *Ireland*, *France*, *Spain* and *Barbary*. But to the Weſtwards of the *Azores*, the Power of the *American* Pole overcoming that of the *European*, the Needle has chiefly reſpect thereto; and turns ſtill more and more towards it as you approach it. Whence it comes to paſs, that on the Coaſt of *Virginia*, *New-Engl.* *New-foundland*, and in *Hudſon's Streights* the *Variation* is Weſtwards; that it Decreaſes as you go from thence towards *Europe*; and that it is leſs in *Virginia* and *New England* than in *Newfoundland*, and *Hudſon's Streights*. This weſterly *Variation* again Decreaſes, as you paſs over the *North America*; and about the Meridian of the middle of *California*, the Needle again Points due North; and from thence Weſtwards to *Yedzo*, and *Japan*, I make no doubt but the *Variation* is Eaſterly; and half Sea over not leſs than 15 *deg.* This *Eaſt Variation* extends over *Japan*, *Yedzo*, *Tartary*, and part of *China*; till it meet with the *Weſterly*, which is governed by the *European North Pole*, and which I ſaid was greateſt ſomewhere in *Ruſſia*.

Towards the Southern Pole the effect is much the ſame, only that here the South point of the Needle is attracted. Hence it will follow, that the *Variation* on the Coaſt of *Brazil*, at the *River of Plate*, and ſo on to the *Streights of Magellan*, ſhould be *Eaſterly* as in the 3*d.* Remark. And this *Eaſterly Variation* doth extend *Eaſtward*, over the greateſt part of the *Ethiopick Sea*, till it be Counterpoiſed by the Vertue of the Southern Pole; as it is about mid-way between the Cape of *Good Hope*, and the Iſles of *Triſtan d'Alcunha*. From thence *Eaſtwards*, the *Aſian* South Pole (as I muſt take the liberty to call it) becoming Prevalent, and the South Point of the Needle being attracted thereby, there ariſes a *Weſt Variation* very great in quantity and extent, becauſe of the great diſtance of this *Magnetical* Pole, from the Pole of the World. Hence it is, that in all the *Indian Sea* as far as *Hollandia nova*, and farther, there is conſtantly *Weſt Variation*: And that under the *Equator* it ſelf, it ariſes to no leſs than 18 *deg.* where 'tis moſt. About the Meridian of the Iſland *Celebes*, being likewiſe that of this Pole, this *Weſterly Variation* ceaſes; and an *Eaſterly* begins; which reaches, according to my *Hypotheſis*, to the middle of the South Sea between *Zelandia Nova* and *Chili*, leaving room for a ſmall *Weſt Variation* governed by the *American* South Pole; which I ſhewed to be in the *Pacifick Sea*, in the 6*th* and 7*th* Remarks.

In the *Torrid Zone*, and particularly under the *Æquinoctial*, reſpect muſt be had to all 4 Poles, and their Poſitions well conſidered, otherwiſe it will not be eaſie to determine what the *Variations* ſhall be; the neareſt Pole being always the ſtrongeſt; yet not ſo, as not to be Counterbalanced ſometimes by the united Forces of two more remote. A Notable Inſtance hereof is in our 8*th* Remark, where I took notice, that in Sailing from St. *Helena*, by the Iſle of *Aſcenſion* to the *Æquator* on a N. W. Courſe, the *Variation* is very little Eaſterly, and in that whole tract Unalterable: For which I give this Reaſon, that the South *American* Pole (which is conſiderably the neareſt in the aforeſaid Places) requiring a great *Eaſterly Variation* is Counterpoiſed by the contrary Attraction of the North *American* and the *Aſian* South Poles; each whereof ſingly is in theſe Parts, weaker than the *American* South Pole; and upon the N.W. Courſe, the diſtance from this latter is very little varied, and as you Recede from the *Aſian* South Pole, the balance is ſtill preſerved by the Acceſs towards the North *American* Pole. I mention not in this Caſe, the *European* North Pole, its Meridian being little removed from thoſe of theſe Places, and of it ſelf requiring the ſame *Vatiations* we here find.

What I have here ſaid does plainly ſhew, the ſufficiency of this *Hypotheſis* for ſolving the *Variations* that are at this Time obſerved. n. 195. p. 564

But there are two Difficulties not eaſie to ſurmount. The one is, that no *Magnet* I have ever ſeen or heard of, hath more than two Oppoſite Poles: Whereas the Earth hath viſibly 4, and perhaps more. Secondly, It is plain by the Change of the *Variation*, not only at *London*, where this Diſcovery was firſt made, but alſo almoſt all over the Earth, that theſe Poles are not at leaſt all of them fixt in the Earth, but ſhift from Place to Place, whereas it is not known that the Poles of the Load-ſtone ever ſhifted their Place in the Stone, nor, conſidering the Compact Hardneſs of that Subſtance, can it eaſily be ſuppoſed. Theſe Difficulties for a long time made me Deſpond, when in Accidental Diſcourſe, and leaſt expecting it, I ſtumbled on the following *Hypotheſis*.

It is ſufficiently known and allow'd, that the *Needles Variation Changes*, and that this *Change* is Gradual and Univerſal, will appear by the following Examples.

At *London*, *An.* 1580. The *Variation* was obſerved by Mr. *Burrows*, to be 11°. 15'. *Eaſt*. In *An.* 1622, the ſame was found by Mr. *Gunter*, to be but 6°. 0. *Eaſt*. In the Year 1634, Mr. *Gellibrand* found it 4°. 5'. *Eaſt*. In 1657. Mr. *Bond* obſerved that there was no *Variation* at *London*. *An.* 1672. my ſelf obſerved it 2°. 30'. to the *Weſt*; and this preſent Year 1692. I again found it 6°. 00'. *Weſt*. So that in 112 Years the Direction of the Needle has changed no leſs than 17 Degrees.

At *Paris*, *Orontius Finaus* about the Year 1550, did account it about 8 or 9 *deg.* *Eaſt Variation*. *An.* 1640. it was found 3 *deg.* *Eaſt*. *An.* 1666. there was no *Variation* there, and *An.* 1681. I found it to be 2°. 30'. to the *Weſt*.

At Cape *d'Agulhas*, the moſt Southerly Promontory of *Africa*, about the Year 1600. the Needle pointed due North and South without *Variation*, whence the *Portugueze* gave its Name. *An.* 1622. There was 2 *deg.* *Weſt Variation*. *An.* 1675. It was 8°. 00'. *Weſt*, and this Year 1692, it was curiouſly obſerved not leſs than 11 *deg.* *Weſt*.

At St. *Helena*, about the Year 1600, the Needle declined 8 *deg.* to the *Eaſt*: *An.* 1623. It was but 6°. 00'. *Eaſt*. *An.* 1677. when I was there, I obſerved it accurately on ſhore to be 0°. 40' *Eaſt*; and now this Year it was found 1°. to the Weſtward of the North.

At Cape *Comorin* in *India*, in the Year 1620, there was 14°. 20'. *Weſt Variation*; in the Year 1680, there was 8°. 48'. but in the Year 1688. it was no more than 7°. 30'. ſo that here the Needle has returned to the Eaſt, about 7°. in 70 Years.

From theſe and many other Obſervations, it is Evident, that the Direction of the Needle is in no place Fixt and Conſtant, tho' in ſome it Change faſter than in others. And where for a long time it has continued, as it were unaltered, it is there to be underſtood, that the Needle has its greateſt Deflection, and is become Stationary, in order to return, like the Sun in the *Tropick*. This at preſent is in the *Indian Sea*, about the Iſland *Mauritius*, where is the higheſt Weſt *Variation*, and in a Tract tending from thence into the N. N. W. towards the *Red Sea* and *Ægypt*. And in all places to the Weſtward of this Tract, all over *Africa* and the Seas adjoining, the Weſt *Variation* will be found to have encreaſed; to the Eaſtwards thereof, as in the Example of Cape *Comorine*, to have decreaſed, *viz*. all over the *Eaſt-Indies*, and the Iſlands near it.

After the like manner in that ſpace of Eaſt *Variation* which, beginning near St. *Helena*, is found all over the *South America*, and which at preſent is higheſt about the Mouth of *Rio de la Plata*, it has been obſerved, that in the Eaſtern Parts thereof, the *Variation* of the Needle gradually Decreaſes. And by Analogy, we may infer, though we have not Experience enough to aſcertain it, that both the Eaſt and Weſt *Variation* in the *Pacifick Sea*, do gradually increaſe and decreaſe after the ſame Rule.

Theſe *Phænomena* being well underſtood, and duly conſider'd, do ſufficiently evince, That the whole *Magnetical Syſtem* is by one, or perhaps more Motions Tranſlated: That this moving thing is very great, as extending its Effects from Pole to Pole; and that the Motion thereof is not *per Saltum*, but by a Gradual and Regular Motion.

Now conſidering the Structure of our Terraqueous Globe, the only way to render this Motion Intelligible and Poſſible, is, to ſuppoſe it poſſible to *Turn about the Center of the Globe, having its Center of Gravity fixt and immoveable in the ſame common Center of the Earth*: And there is yet required, that this moving Internal Subſtance be Looſe, and detached from the External Parts of the Earth whereon we live. So then the External Parts of the Globe may well be reckoned as the Shell, and the *Internal* as a *Nucleus* or *Inner* Globe included within ours, with a fluid Medium between. Which having the ſame common Center and Axis of Diurnal Rotation, may turn about with our Earth, each 24 Hours; only this Outer Sphere having its Turbinating Motion, ſome ſmall matter either ſwifter or ſlower than the *Internal Ball*, and a very Minute difference in length of time, by many Repetitions becoming ſenſible, the *Internal* Parts, will, by degrees, recede from the *External*, and not keeping pace with one another, will appear gradually to move either Eaſtwards or Weſtwards by the difference of their Motions. So that if this *Exterior* Shell of Earth be a Magnet, having its Poles at a diſtance from the

Poles of *Diurnal Rotation*; and if the *Internal Nucleus* be likewiſe a Magnet, having its Poles in two other Places diſtant alſo from the *Axis*, and theſe latter by a Gradual and ſlow Motion, Change their place in reſpect of the *External*, we may then give a reaſonable Account of the four Magnetical Poles, as likewiſe of the Changes of the Needle's *Variations*, which, till now, hath been unattempted.

The Period of this Motion being wonderful great, and there being hardly an Hundred Years ſince theſe *Variations* have been duly obſerved, it will be very hard to bring this *Hypotheſis* to a *Calculus*, eſpecially ſince, tho' the *Variations* do increaſe and decreaſe Regularly in the ſame Place, yet in differing Places, at no great diſtance, there are found ſuch caſual Changes thereof, as can no ways be accounted for by a regular *Hypotheſis*; as depending upon the unequal and irregular Diſtribution of the Magnetical matter within the ſubſtance of the *External* Shell or Coat of the Earth, which defect, the Needle from the Poſition, it would acquire from the Effect of the general Magnetiſm of the whole. Of this the *Variations* at *London* and *Paris* gave a notable inſtance: For the Needle has been conſtantly about 1°½ more Eaſterly at *Paris* than at *London*, tho' it be certain according to the general Effect, the difference ought to be the contrary way. Notwithſtanding which the *Variations* in both places do change alike. Hence, and from ſome other of like nature, I conclude, That the Two Poles of the *External* Globe are fixt in the Earth, and that if the Needle were wholly govern'd by them, the *Variations* thereof would be always the ſame, with ſome little Irregularities upon the account I but juſt now mentioned: But the *Internal* Sphere having ſuch a gradual Tranſlation of its Poles, does Influence the Needle, and direct it Variouſly, according to the reſult of the Attractive or Directive Power of each Pole; and conſequently there muſt be a Period of the Revolution of this *Internal* Ball, after which the *Variations* will return again as before.

If then Two of the Poles be fixt, and Two Moveable, I think we may ſafely determine that the *European* Pole is that that is moveable of the Two *Northern Poles*, and that that has chiefly influenced the *Variations* in theſe Parts of the World: For in *Hudſon's Bay*, which is under the Direction of the *American* Pole, the Change is not obſerved to be near ſo faſt as in theſe Parts of *Europe*, tho' the Pole be much farther removed from the *Axis*. And that the *Aſian*, of the two *South Poles* is fixt, and conſequently the *American* moveable; from the like Obſervation of the ſlow Decreaſe of the *Variation* on the Coaſt of *Java*, and near the *Meridian* of the *Aſian* Pole.

If this be allowed me, 'tis plain that this Motion is *Weſtwards*, and by Conſequence that the aforeſaid *Nucleus* has not preciſely attained the ſame Degree of Velocity with the *Exterior* parts in their *Diurnal Revolution*: But ſo very nearly equals it, that in 365 Revolves, the difference is ſcarce ſenſible. This, I conceive, to ariſe from the Impulſe, whereby this Diurnal Motion was Impreſt on the Earth, being given to the *External* Parts, and from thence in Time communicated to the *Internal*.

The *Period* of this Motion appears, by all Circumſtances, to be of many Centuries of *Years*; and conſidering the Change of the Place, where there was no *Variation*, by reaſon of the Æquilibre of the Two Southern *Magnetical Poles*, *viz.* from Cape *d'Agulhas* to the Meridian of St. *Helena* (which is about 23°. in about 90 *Years*,) and of the Place where the Weſterly *Variation* is in its ἀκμὴ or greateſt Deflection, being about half ſo much, *viz.* From the Iſle of *Diego Roiz* to the South-Weſt Parts of *Madagaſcar*; we may with ſome Reaſon Conjecture, that the *American Pole* was moved Weſtwards 46°. in that Time; and that the whole *Period* thereof is performed in Seven Hundred Years, or thereabouts: So that the Nice Determination of this, and of ſeveral other Particulars in the *Magnetick* Syſtem, is reſerved for remote Poſterity.

I doubt not but this *Hypotheſis* of an *Internal Nucleus* will find Oppoſers enough: But the Globe of *Saturn* being environ'd with his Ring, is a Notable Inſtance of this kind, as having the ſame common Center, and moving along with it without ſenſibly approaching one ſide of it more than another: And if this Ring were turned on one of its Diameters, it would then deſcribe ſuch a *Concave Sphere* as I ſuppoſe our *External* one to be. And ſince the Ring in any Poſition given, would, in the ſame manner, keep the Center of *Saturn* in its own, it follows that ſuch a *Concave Sphere* may move with another included in it, having the ſame common Center. Nor can it well be ſuppoſed otherwiſe, conſidering the Nature of *Gravity*: For ſhould theſe Globes be adjuſted once to the ſame common Center, the *Gravity* of the Parts of the *Concave*, would preſs equally towards the Center of the *Internal* Ball, which equality muſt neceſſarily continue till ſome External Force diſturb it; which is not eaſie to imagine in our Caſe. This perhaps I might more intelligibly expreſs, by ſaying, That the Inner Globe being poſited in the Center of the *Exterior*, muſt neceſſarily Aſcend, whatſoever way it move; that is, it muſt overcome the Force of *Gravity* preſſing towards the common Center, by an Impulſe it muſt receive from ſome outward Agent: But all outward Efforts being ſufficiently fenced againſt, by the Shell that ſurrounds it, it follows, that this *Nucleus* being once fixt in the common Center, muſt always there remain.

It may be objected, that the Water of the Sea would perpetually Leak through this Shell, unleſs we ſuppoſe the Cavity full of Water: But when we conſider how tightly great Beds of Chalk or Clay, and much more Stone, do hold Water, and even Caves Arched with Sand, no Man can doubt but the Wiſdom of the Creator has provided for the *Macrocoſm*, by many other ways than I can either Imagine or Expreſs. We cannot think it a hard ſuppoſition that the internal Parts of this Bubble of Earth ſhould be Replete with ſuch *Saline* and *Vitriolick* Particles as may contribute to Petrefaction, and diſpoſe the tranſuding Water to ſhoot and Coagulate into Stone, ſo as continually to fortifie, and, if need were, to Conſolidate any breach or flaw in the Concave Surface of the Shell. And this perhaps may, not without Reaſon, be ſuppoſed to be the Final Cauſe of the Admixture of the *Magnetical* Matter in the Maſs of the *Terreſtrial* Parts of our Globe, *viz*. To make good and maintain the Concave Arch of this Shell: For by what the Excellent Mr. *Newton* has ſhewn, in his *Principia Philoſophia*, it will follow, That according to the general Principle of Gravity, Viſible throughout the whole Univerſe, all thoſe Particles that by length of Time, or otherwiſe, ſhall molder way, or become looſe on the Concave Surface of the External *Sphere*, would fall in, and with great force deſcend on the Internal, unleſs thoſe Particles were of another ſort of Matter capable by their ſtronger tendency to each other, to ſuſpend the force of Gravity; but we know no other Subſtances capable of ſupporting each other by their *Mutual Attraction*, but the *Magnetical*; and theſe we ſee miraculouſly to perform that Office, even where the Power of Gravity has its full Effect, much more within the Globe where it is weaker. Why then may we not ſuppoſe theſe ſaid Arches to be lined throughout with a *Magnetical* Matter, or rather to be one great Concave Magnet, whoſe two Poles are the Poles we have before obſerved to be Fixt in the Surface of our Globe.

Another Argument favouring this *Hypotheſis*, is drawn from a Propoſition of the ſame Mr. *Newton*, where he determines the force wherewith the Moon moves the Sea in producing the Tides: His Words are, *Denſitas* Lunæ *eſt ad Denſitatem* Terræ *ut* 680 *ad* 387. *ſeu* 9 *ad* 5. *quam proxime. Eſt igitur Corpus* Lunæ *Denſius, ac magis* Terreſtre *quam* Terra noſtra. Now if the Moon be more Solid than the Earth as 9 to 5, why may not we reaſonably ſuppoſe, the Moon being a ſmall Body, and a Secondary Planet, to be ſolid Earth, Water and Stone, and this Globe to conſiſt of the ſame Materials, onely 4 Ninths thereof to be Cavity, within and between the Internal Spheres, which I would render not Improbable.

It muſt be allowed indeed, that theſe Included Globes can be of very little ſervice to the Inhabitants of this Outward World nor can the Sun be ſerviceable to them, either with his Light or Heat: But ſince we ſee all the Parts of the Creation abounds with Animate Beings, why ſhould we think it ſtrange that the Prodigious Maſs of Matter, whereof this Globe does conſiſt, ſhould be capable of ſome other Improvements, than barely to ſerve to ſupport its Surface? Why may we not rather ſuppoſe that the exceeding ſmall quantity of ſolid Matter in reſpect to the fluid Æther, is ſo diſpoſed by the Almighty Wiſdom, as to yield as great a Surface for the uſe of Living Creatures, as can conſiſt with the Conveniency and Security of the whole.

And tho' without Light, there can be no Living, yet there are many ways of producing Light which we are wholly Ignorant of: The Medium it ſelf may be always *Luminous* after the manner of our *Ignes fatui*; the Concave Arches may in ſeveral places ſhine with ſuch a Subſtance as inveſts the Surface of the Sun; nor can we without a Boldneſs unbecoming a Philoſopher, adventure to aſſert the Impoſſibility of *Peculiar Luminaries* Below, of which we have no ſort of *Idea*.

Thus I have ſhewed a Poſſibility of a much more ample Creation, than has hitherto been imagined: A Notion till hitherto not ſo much as ſtarted in the World, and of which we could have no Intimation from any other of the *Phænomena* of Nature.

But there may be a farther uſe of this Cavity of the Earth; *viz.* to diminiſh the *Specifick Gravity* thereof in reſpect of the Moon; for I think I can Demonſtrate that the Oppoſition of the *Æther* to the Motions of the *Planets* in long Time becomes ſenſible, and conſequently the greater Body muſt receive a leſs Oppoſition than the ſmaller, unleſs the *Specifick Gravity* of the ſmaller do proportionably exceed that of the greater, in which Caſe only they can move together. So that the Cavity I aſſign in the Earth, may well ſerve to adjuſt its Weight to that of the Moon: For otherwiſe the Earth would leave the Moon behind it, and ſhe become another Primary Planet.

An Invariable Compaſs, By M. de la Hire. n. 188. p. 344.

IX. 1. Having determined, as well as I could the *South Pole* of a *Terrella* or *Spherical Loadſtone*, of 3 Inches Diameter which accidentally had fallen into my Hands, I was much ſurpriſed to find it 18°. diſtant from a Croſs, deep engraven on the Stone, which according to all appearance had heretofore been the Pole of this Stone, as it had been obſerved by him that cut it. This Change having revived ſome Thoughts I had formerly entertained concerning the *Variation* of the Needle, I believed that if it were True that the Poles of the *Magnetical* Vertue changed in the Loadſtone, as we ſee they change in the Earth, one might derive great Advantages therefrom: For if this Change of theſe *Poles* in the Loadſtone were certain, and that it was Analogous to the Change of the *Poles* of the *Magnetick* Vertue in the Earth, it is not to be doubted but a *Terrella*, being ſuſpended at Liberty, would remain Immoveable, and that one Point thereof would regard the *Pole* of the World, which might be called the True *Pole* of the Stone, whilſt the *Poles* of its Vertue would paſs ſucceſſively from one part to another, after the ſame manner as they Change in the Earth.

After having well conſidered this *Hypotheſis*, and having cleared up ſome doubts which I had, concerning the Poſition of the Stone at the time when its *Pole* had formerly been determined, I concluded that this former *Pole* was diſtant from the Point I call the True *Pole*, 13 Degrees towards the Eaſt, in the Place where it had been marked, (and which is unknown to me,) ſince that at this Time in this Country the Needle *Varies* about 5 *deg.* Weſtward.

Upon this *Hypotheſis*, which I know not that any one elſe has yet thought upon, I have invented a new ſort of Needle for the Compaſs, which may have the ſame Alterations as a *Spherical Loadſtone*, and at the ſame time the ſame Conveniencies as the Ordinary Needle hath.

I cauſed a Ring of 3 Inches Diameter to be made of *Steel-Wire*; from which there went 3 *Radii* of very fine *Braſs Wire* meeting at the Center in a *Cap* perfectly like that of an ordinary Compaſs, that ſo this Circle might reſt on a Pin in its Center, and be at full Liberty to turn round, its Center being fixt. This done, I gave the *Magnetical Touch* to this *Steel Ring*, by applying indifferently to a Point thereof, one of the *Poles* of a ſtrong *Load-ſtone*, and the other Pole of the Stone to the oppoſite Point, to give the greater Vertue to the Ring. Then I obſerved that the Ring was ſtrongly magnetical, and that the Point called the *South Pole* did readily turn it ſelf towards the North, and after ſeveral Vibrations ſtopped there, and that it had alſo the ſame Inclination towards the Pole which is found in Needles after they have been touched: Laſtly, I fix'd upon the Ring a ſmall *Fleur de Lis* of Braſs in the Point, which exactly reſpected the North, the Ring being firſt well ſettled.

To inform my ſelf, if this *Steel Ring* had the ſame Effects as a *Terella*, I made the following Experiment. Having touched a *Steel Ring*, and having laid it on a Paper, I ſtrewed the Filings of Steel upon it, and then gently ſhaking the Paper, I ſaw that the Direction of the Magnetical Matter paſſed directly croſs the Ring from one Pole to the other, and that there were two Vortices on the ſides, as it is obſerved in the *Spherical Magnet*, which ſeems very ſurpriſing; for according to the ordinary *Hypotheſis* of the Magnet, the Magnetical Vertue paſſing more eaſily in the Steel than in the Air, ſhould run on both ſides of the *Pole* round the Ring, and only form a Pole oppoſite to the firſt. But I was further confirmed in this Opinion, by applying a flat and pointed piece of Iron like the Blade of a Knife, to a *Loadſtone*, ſo as the Point of the Iron reached beyond the *Stone*; and having afterwards preſented this Point to the *magnetical Ring*, I obſerved that different Points of the *Ring* did apply to the Point of the Iron, according as the ſeveral Points thereof had been applied to the Stone, which happens not in the magnetical *Needle*, for that always preſents one of its ends to the Point of the Iron, being not diſpoſed, by reaſon of its Length, to receive the *magnetical* Matter in all the Parts thereof analogous to thoſe of the Stone. It muſt only be noted, that in an irregular Stone, the Magnetical Vertue appears ſtronger towards the Angles than in the other Parts, which may cauſe ſome Irregularity in this Experiment, if it be tried with a Stone that is very uneven.

Thoſe Experiments gave me the Curioſity of making another, by touching two Semicircles of Steel. Having joyned the two Ends, touched by the ſame Poles, I obſerved by the *Steel-Duſt* the ſame Effect as in the Ring; but having joyned the Ends differently touched, I found that immediately the two half Rings run together, and ſtuck to each other; and by the Steel-Duſt ſtrowed on Paper, I obſerved, that there were 4 Vortices, one in the middle of each Semicircle, and one at each of the Places where they were joyned, and that the 2 latter were leſs than the others, and much ſtronger. I ſaw likewiſe, that there were 4 Poles, each of which was within a Vortex, and that each retained in its Semicircle the Vertue of the Ends of the half Rings.

I tried, after having touched a *Steel Wire* that was ſtraight, to make a Ring thereof. But I found, that it had quite loſt its Vertue, which cannot be attributed to the Junction of the Poles, ſince they ought to ſtick together, according to the other Experiments which have been made, but only to this, that it hath been already noted, that when a Magnetical Virgula is a little bent, it loſes its *Vertue*, which cannot happen, but from the Alteration of the Pores of the Steel.

I farther remarked, that a Ring of *Steel* having been touched, does for a long time retain its vertue, although it be put in a Poſition contrary to its *Poles*. And this Experiment is confirmed by another much more conſiderable, which is, that a *Ring* of Steel having been touched with a ſtrong *Loadſtone*, cannot without difficulty receive a contrary Touch from a *Magnet*, leſs ſtrong than the firſt: But that in Time, by little and little, it reſumes its former vertue; much as we ſee Magnets do, which being applied to another Stone, by the Poles of the ſame Denomination, loſe their firſt Vertue and take a contrary, which they afterwards loſe by Degrees, to reaſſume their firſt.

After I had preſented this new Syſtem of the Magnet to the *Academy*, there were made ſome Experiments upon a *Terrella* of much the ſame Diameter with mine, but whoſe Poles were not diametrically oppoſite; and upon a half Globe, very much bigger than the *Terrella*: But we could find in them no Conſiderable Difference, or Alteration of Poles. Becauſe of ſome Circumſtances, the Company thought fit that ſome Experiments ſhould be made with this Sort of Compaſs.

Theſe *Circular Needles* may be touch'd anew after this Manner; Apply the *Poles* of the *Stone* to the Ring, and the Ring which is ſuſpended upon its *Pivot*, will turn ſo, as the Point anſwering to the Pole of the vertue of the Stone which is applied to it, will come as near to it as poſſible: Inſomuch, that without touching the one or the other, the Ring will not fail to receive very much Force. The ſame may be done at the oppoſite Point.

The Principle examined by ...., ib. p. 250.

2. This Account having been read before the *Royal Society*, it was ordered, that the *Terrella* which has been in their *Repoſitory* theſe 25 Years, ſhould be examined; and it was found, that the Points which are marked thereon with *Croſſes*, were as near as could be diſcerned, the true Poles of the Stone, notwithſtanding that the Variation has changed at *London* full 4 *deg.* ſince the *Terrella* has been in the *Society*'s Cuſtody, and perhaps many more ſince it was marked; and had there been a Change in the Poles of the *Loadſtone* analogous thereto, it muſt needs have been perceived in this, whoſe Diameter is about 4½ *Inches*. However to put this Matter paſt Diſpute, Care was taken to find out exactly and mark the Poles of the *Societies* great *Loadſtone*, the Sphere of whoſe Activity is above 9 foot *Radius*, and whoſe Poles are 13 inches aſunder; whereby if this Tranſlation of the Poles be real, it cannot fail of being made very ſenſible hereafter. In the mean time, ſome of the Company well skill'd in Magneticks, were of Opinion, that ſuch a *Circular Needle* would librate on its Center, ſo as to reſpect the Magnetical Meridian with the Points that had at firſt received the *Touch*, rather than that the Ring remaining immoveable, the directive Vertue ſhould be transferred

therein from Place to Place, either by length of time, or by tranſporting this Compaſs into thoſe Parts, where the *Variation* of the *Needle*, is conſiderably different.

An Account of a Book, Omitted.

Epiſtola invitatoria, ad Obſervationes Magneticæ Variationis, communi Studio junctiſque Laboribus, inſtituendas, *Altorfi*, 1682.

n. 143. p 3

CHAP. V.

Botany. Agriculture.

I. PRepare two Plates of *Iron* as large as you deſire to preſerve the *Specimens.* Theſe Plates muſt be too thick to bend, very ſmooth on one ſide, and Holes for Screws on each Corner, to ſcrew them cloſe. Then take your *Flowers*, *Leaves*, *&c.* when perfectly ripe, and in their true Colours, ſpread them on a Brown-Paper, with the Leaves as diſtinct as you can, and if the Flowers be large, there muſt more Paper lie under it, and if it be thick, you may pare away the one half thereof, as alſo of the Stalk, ſo as to make it lie almoſt flat and ſome diſtinct Leaves may be ſeparated and taken out, as a By-ſtore, to be afterwards ſtuck in, and compleat the Flower. Then lay, over all more Brown-Paper, and put theſe between the Iron Plates, ſcrew 'em cloſe, put the ſame into an Oven for two Hours, juſt as the Bread is drawn; after which, take out the Flowers; then take *Aqua-fortis* and *Aqua vitæ*, or *Brandy*, in equal Quantity, mixed together, and with a Bruſh paſs over the Leaves of the Flowers. Then lay them on freſh Brown-Paper, and preſs them a little with a Handkerchief, or with your Fingers, to grow dry. Then take the Bigneſs of a Walnut of *Gum-Dragon*, which in leſs than 24 Hours, will be diſſolved in a Pint of fair Water; and with a fine Bruſh, rub the Backſides of your Flowers and Leaves, to make them ſtick, and then lay them into your Paper Book, where they will lie faſt, and always look freſh.

To preſerve the Speci-mens of Plants, by *Sir Robert* Southwell, n: 237, p. 42.

There muſt be a little Skill after the Oven, to turn the Leaves into Shape, and a ſort of Perſpective, in Caſe the Flower be too thick, and if you would add any Smell to theſe Flowers, which will have none, touch them with ſuch Eſſence as you think fit.

II. 1. As I paſſed thro' *Marton* Woods, under *Pinno moor* in *Craven*, *Aug.* 18, 1672, I found an infinite Number of *Muſhrooms*, ſome withered, and others new ſprung and flouriſhing. They were of a large Size, ſomething bigger than the ordinary *Red gilled eatable Muſhroom*, or *Champignon*, and very much of their Shape; that is, with a perfectly round Cap, or Stool, as we vulgarly call it, thick in Fleſh, and with open Gills underneath, having a thick, fleſhy not hollow, and round Foot Stalk, of about 6 Fingers

An odd kind of Muſhroom by Dr: Liſter n, 89, p, 5116 gers Breadth high above Ground, and ordinarily as thick as my Thumb. If you cut any part of this *Muſhroom*, it will bleed exceeding freely a Milk white Juice, which taſtes much hotter upon the Tongue than *Pepper*, it is not clammy to the Touch, and the Air does not much diſcolour it, or the Blade of a Knife, as is uſual with moſt vegetable Juices. It became in the Glaſs Vial I drew it into, ſuddenly concrete and ſtiff, and did in ſome days dry into a firm Cake; which alſo when well dried, retained its fierce biting Taſt and white Colour.

Further, I obſerved theſe *Muſhrooms* full of Juice, not to be endured upon our Tongues, to abound with *Fly Maggots*. Alſo the youngeſt and tendereſt of them, that is, ſuch as are moſt juicy, to have been very much eaten by the grey Meadow-naked Snail, lodging themſelves within the ſide of the Plant.

By Mr. *Wray*, ib: p. 5117.

2. I doubt not but this *Muſhroom* is that deſcribed in *Joh. Bauhin*, *l.* 40. c. 6. under the Title of *Fungus Piperatus Albus*, *Lacteo Succo turgens*. For in almoſt all Points the Deſcriptions agree exactly.

Another ſort of Muſhrooms by Dr. *Liſter*, n: 110. p. 225

3. The *Fungus poroſus Craſſus magnus*, *J. B.* when freſh gathered, is of a *Buff Colour*, inſide and outſide, and yet cut thro' the Middle, it will in a Moment change from a Pale Yellow to a deep Purple or Blue, and ſtain Linen accordingly. A Drop of the Juice leiſurely ſqueezed out, will change, holding it betwixt your Eye and the Light, thro' all the Colours of the Rainbow, in the very time of its falling, and fix in a Purple, as it doth in the ſpringing out of its Veins.

The Flowers and Seed of Muſhrooms, by Dr. *Liſter*, n. 110: p. 225

III. I am of Opinion, that Muſhrooms are Plants of their own kind, and have more than a chance Original. We will inſtance in that ſpecies call'd *Fungus Poroſus Craſſus magnus*, J. B. The Texture of the *Gills* is like a Paper prick'd full of *Pin holes*. In *Auguſt* this is very frequent under Hedges, and in the middle of the Moors in many places of *Yorkſhire*. It ſeems to me, (and no doubt, it will to any Perſon that ſhall well examine it,) that the *Gills* of this Muſhroom are the very Flower and Seed of this Plant. When it is ripe, the *Gills* here are eaſily ſeparable from the reſt of the Head: Each Seed is diſtinct from other, and hath its Impreſſion in the Head of the Muſhroom, juſt as the Seeds of an *Arrichoke* hath in the Bottom of it. The bigger End of the Seed is full and round, and they are diſpoſed in a ſpiral Order, juſt as thoſe of the *Artichoke*. The like we do think of all other Muſhrooms, however differently figured.

And if it ſhall happen to him that ſhall ſow them, that theſe will not produce their Kind, but be ſterile, it is no ſtrange thing amongſt Plants, there being whole Genus's of Plants that come up, and Flower, and Seed, yet their Seed was never known to produce Plants of their Kind: Being naturally ſterile, and a volatile Duſt, as all the *Orchides* or *Bee-Flowers*.

Truffles, by Dr. Tanc: Robinſon, n: 202: p: 814: 824. n: 104: p. 935.

IV. The *Tubera Terræ* obſerved lately at *Ruſhton* in *Northamptonſhire*, by Dr. *Hatton* of *Harborough* in *Leiceſterſhire*, are the true *French Truffles*, the *Italian* [illegible] *Tartufi*

Tartuſi or *Tartuffole*, and the *Spaniſh Turmas de Tierá*, which are not noted by Mr. *Ray*, to be found in our *Britiſh Soil*. I have ſeen 'em thrice as large at *Florence*, *Rome* and *Naples*, where they eat them as a delicious and luxurious Piece of Dainty, either fryed in Slices with Butter or Oyl, Salt and Pepper, or elſe out of Pickle, and often boyled in their Soup. Theſe obſerv'd in *England* are all included in a ſtudded Bark or Coat, the *Tubercules* reſembling the *Capſules* or *Seed Veſſels* of ſome *Mallows* and *Alcea*'s. The inward Subſtance is of the Conſiſtence of the fleſhy Part in a young Cheſtnut, of a Paſte Colour, of a Rank or *Hircine* Odour, and unſavory, ſtreaked with many white Veins or Threads, as in ſome Animals Teſticles. The whole is of a *Globoſe* Figure, tho' unequal and chinky; they are moſt tender in the Spring, tho' after Showers and ſultry Weather, they may be plentifully found in the Autumn. The Wet ſwells them, and Lightning and Thunder may diſpoſe them to ſend forth their particular Scent ſo alluring to the Swine, for ſome of the Ancients call'd them *Ceraunia*.

Fig. 157

Fig. 158.

Dr. *Hatton* obſerved *Fibres* iſſuing out of ſome of theſe *Tubera*, which lay Spit deep under Ground, ſo that perhaps they may be *Planta ſui generis*, and their ſulcated *Papillæ* analogous to, if not *Seed Veſſels*; you know ſeveral Vegetables bear their Seed near the Root, as the *Trifolium ſubterraneum Tricoccum*, *Reticulatum Floſculis longis albis*, moſt of the *Arachidna*'s, and ſome other *Legumes*, which Flower above, but Seed under Ground. As to the *Truffles* lying ſo deep, that is common to many Roots that ſhoot up Stalks above the Earth. To inſtance only in that *Lathyrus tuberoſus*, call'd commonly *Chamæbalanus* and *Terræ Glandes*, in *Engliſh Peaſe Earthnut*, digg'd up and eaten by the poor People, non niſi alta Foſſione inveniendæ, ſays *John Bauhine*. The Roots of our *Bulbocaſtanum* (of the umbelliferous Tribe) commonly call'd *Kepper-nuts*, *Pignuts* and *Gernuts*, in the North, lie very deep, and fatten Hogs, which are very greedy of them.

Fig. 157.

V. Some years ſince M. *Perrault* related to the *Royal Academy* at *Paris*, that travelling thro' *Sologne*, he had been inform'd by ſome Phyſicians and Chirurgeons of that Country, that the *Rey* there was ſometimes ſo corrupted, that thoſe who did eat of the Bread which had much of this *corrupted Grain* in it, were ſeized on by a *Gangrene*. We have viewed ſome of theſe Grains of *Rey* thus degenerated, they are black without, and pretty white within, and when they are dry, they are harder and cloſer than the natural *good Grain*. They have no ill Taſte. I have found ſome of them that had hanging at their Baſis a Subſtance of a Honey Taſte and Conſiſtence. They become much longer in the Ear than the other. There are ſome of them that are 13 or 14 Lines long, and 2 Lines large, and at times you will find 7 or 8 of them in one Ear. It may be ſeen in examining theſe Ears, that they are not Bodies of another kind, generated among the Grains of *Rey*, as ſome pretend; but that they are true Grains of *Rey* having their Coats like the reſt, wherein may be diſtinguiſh'd the Place of the Germen, and of the Furrow.

A ſtrange ſort of Rey in France, by , , , n: 130, p: 758.

There happened many like Accidents in 1674, at *Montargis* from the ſame Cauſe. M. *Dodart* cauſed to be brought to him ſome Ears of this Rey, and the Company found the Grains of them altogether like thoſe they had ſeen formerly.

M. *Tuillier* hath imparted a Letter of M. *Chatton*, an old and expert Chirurgeon at *Montgaris*, whence he ſaith he hath learned the Particulars following, *viz*. *Rey* doth in this manner *degenerate* in *Sologne*, *Berry*, the Country of *Blaiſe* and *Gaſtinois*, and almoſt every where, eſpecially in light and ſandy Land. There are few Years but ſome little of this *ill Grain* grows. When there is but little, the ill effects of it are not perceived. It grows plenteouſly in wet Years, and moſt of all when after a rainy Spring there follows exceſſive Heats. The Conſtitution of the Air or of the Rains, which impreſs this *malignity* in the *Rey* is rare, there having been found none at *Montgaris* but thrice in 38 Years, and there having been but few Diſtempers of it the ſecond time, becauſe there was but little of that corrupted Grain. The Bread made of the *Rey*, which hold ſome of this corrupted Corn, taſts neither worſe nor better than other. The *Rey* thus corrupted, hath its Effects chiefly when 'tis new, yet not till it hath been uſed a conſiderable time.

Theſe Effects are, to dry up the Milk in Women, to cauſe ſometimes malign *Fevers*, accompanied with *Drowſineſs* and *Raving*, to breed the *Gangrene* in *Arms*, but moſt in *Legs*, which ordinarily are corrupted firſt, and to which this Diſtemper faſtens it ſelf, as the *Scorbute* doth. This Corruption is preceeded by a certain *Stupefaction* in the Legs, upon which follows a little Pain, and ſome Swelling without Inflammation, and the Skin becomes cold and livid. The *Gangrene* begins at the Center of the Part, and appears not at the Skin but a long while after, ſo that People are often obliged to open the Skin to find only the *Gangrene* lurking under it.

The only Remedy for this *Gangrene* is to cut off the Part affected: If it be not cut off, it becomes dry and lean, as if the Skin were glued over the Bones, and 'tis of a dreadful Blackneſs, without Rottenneſs.

Whilſt the Legs are drying up, the *Gangrene* aſcends to the Shoulders, and one knows not which way it communicates it ſelf.

We have not as yet lighted upon a Specifick Remedy againſt this Evil. There is ſome Hope of preventing it by *Hot Spirits*, and *Volatile Salts* The *Orvietan* and *Ptyſan* of *Lupins*, do conſiderable Good to the Perſon diſtempered. Poor People are almoſt only ſubject to theſe Evils.

M. *Tuillier* alſo writes Word, that in 1675 he ſaw much of this cornuted Grain among the *Rey* of the Country of *Gaſtinois*; and that the Country People told him, that there was much more of it this Year 1676, than the laſt Year, and that it cauſed great Diſorders; and yet 'tis certain, that this Summer hath been rather Cold than Hot, and that there hath not been any conſiderably intemperate Weather this Year, but Exceſs of Wet.

However, it may be doubted, whether theſe *Gangrenes* are the Effects of this *Corn* eaten, or whether the *Corruption* of the *Rey* and that of the *Parts* in the *Bodies* of Men, are not Accidents equally derivable from the ſame Conſtitution of the Air, and independent the one from the other. Yet M. *Tuillier* has aſſured M. *Dodard*, that in the Year 1630, which was fatal to the Poor of the Countries ſubject to theſe Evils, he being at *Sully*, and having underſtood by a Phyſician and Chirurgeon, that the *Cornuted Rey* was the Cauſe of the *Gangrenes* that were then very frequent, being deſirous to ſatisfy himſelf whether this Grain was indeed the Cauſe thereof, he gave of it to ſeveral Animals, which dy'd of it.

To make Malt, by Sir Rob. Murray, n. 142. p. 1069.

VI. Malt is made in *Scotland* of no other Grain but *Barley*, whereof there are 2 kinds; 1, which hath 4 Rows of *Grains* on the *Ear*, the other 2 Rows. The firſt is the more commonly uſed, but the other makes the beſt Malt.

The more recently *Barley* hath been threſhed, it makes the better Malt. But if it hath been threſh'd 6 Weeks or upwards, it proves not good Malt, unleſs it be kept in one equal Temper; whereof it eaſily fails, eſpecially if it be kept up againſt a Wall; for that which lies in the middle of the Heap is freſheſt; that which lies on the Outſides and at Top is over dry'd, that which is next the Wall, ſhoots forth; and that which is at the Bottom rots. So that ſome Grains do not come well (as they call it) that is, never gets that right mellow Temper Malt ought to have, and ſo ſpoils all the reſt. For thus ſome Grains come well, ſome not at all, ſome half, and ſome too much.

The beſt way to preſerve Threſhed *Barley* long in good Temper, is not to ſeparate the Chaff from it, but as long as it is unthreſhed, it is always Good. Brewers uſe to keep their *Barley* in large Rooms on boarded Floors, laid about a Foot in Depth, and ſo turned over now and then with Scoops.

Barley that hath been overheated in the Stacks or Barns, before it be ſeparated from the Straw, will never prove good for Malt, nor any other Uſe. But tho' it heat a little after it is Threſhed and kept in the Chaff, it will not be the worſe, but rather the better for it, for then it will come the ſooner, and more equally. A Mixture of *Barley* that grows on ſeveral Grounds, never proves good Malt, becauſe it comes not equally. So that the beſt *Barley* to make Malt of, is that which grows in one Field, and is kept and threſh'd together.

Take then good *Barley*, newly Threſhed, and well purged from the *Chaff* and put hereof 8 *Bolls*, that is about 6 *Engliſh Quarters*, in a *Stone Trough*, where let it infuſe, till the Water be of a bright reddiſh Colour; which will be in about 3 Days, more or leſs, according to the Moiſtneſs or Dryneſs, Smalneſs or Bigneſs of the Grain, Seaſon of the Year, or Temper of the Weather. In Summer Malt never makes well; in Winter it will need longer Infuſion, than in the Spring or Autumn.

It may be known when ſteeped enough, by other Marks beſides the Colour of the Water, as the exceſſive Swelling of the Grain, or if over-ſteeped, by too much Softneſs; being, when in the right Temper, like that *Barley* which is prepared to make Broth of.

When the *Barley* is ſufficiently ſteeped, take it out of the Trough, and lay it on Heaps, ſo let the Water drain from it. Then after 2 or 3 Hours, turn it over with a Scoop, and lay it in a new Heap, about 20 or 24 Inches deep.

This Heap they call the coming Heap, and in the managing of this Heap aright, lies the greateſt Skill. In this Heap it will lie 40 Hours, more or leſs, according to the forementioned Qualities of the Grain, *&c.* before it come to the right Temper of Malt; which that it may do equally, is moſt to be deſired.

Whilſt it lies in this Heap, it is to be carefully looked to, after the firſt 15 or 16 Hours: For about that Time, the Grains will begin to put forth the Root, which when they have equally and fully done, the Malt muſt within an Hour after be turned over with a *Scoop*, otherwiſe the Grains will begin to put forth the *Blade* or *Spire* alſo, which by all means muſt be prevented; for hereby the Malt will be utterly ſpoil'd, both as to the Pleaſantneſs of Taſt and Strength.

If all the Malt come not equally, becauſe that which lies in the Middle being warmeſt will uſually come firſt, turn it over, ſo as the utmoſt may lie inmoſt, and ſo leave it till all become alike.

So ſoon as the Malt is ſufficiently come, turn it over, and ſpread it to a Depth not exceeding 5 or 6 Inches: and by that Time it is all ſpread out, begin and turn it over and over again, three or four Times. Afterwards, turn it over in like Manner, once in 4 or 5 Hours, making the Heap thicker by Degrees, and continuing ſo to do conſtantly, for the ſpace of 48 Hours at leaſt. This frequent turning it over, cools, dries, and deads the Grain, whereby it becomes mellow, melts eaſily in Brewing, and then ſeparates entirely from the Husk.

Then throw up the Malt into a Heap, as high as you can, where let it lie, till it grows as hot as your Hand can endure it, which uſually comes to paſs in ſome 30 Hours Space. This perfects the Sweetneſs and Mellowneſs of the Malt.

After the Malt is ſufficiently heated, throw it abroad to cool, and turn it over again about 6 or 8 Hours after, and then dry it upon a Kiln. Where after one Fire, which muſt ſerve for 24 Hours, give it another more ſlow, and if need be, a third. For if the Malt be not throughly dryed, it cannot be well ground, neither will it diſſolve well in the Brewing, and the Ale it makes will be red, bitter, and will not keep.

The beſt Fewel is *Peat*, the next *Charcoale*, made of Pit-Coal or Cynders. *Heath*, *Broom*, and *Furzes*, are nought. If there be not enough of one Kind, burn the beſt firſt, for that gives the ſtrongeſt Impreſſion as to the Taſte.

The Granaries in *London*, by *Dr.* Merret, n. 25. 2 5. p. 464.

VI 1. All the 12 *Companies* of *London*, and ſome other Companies, and private Perſons, have their Granaries at the *Bridge-Houſe* in *Southwark*: (where are a Juſtice of the Peace, a Steward, and two Maſters) Theſe Granaries are built on two Sides of an oblong Square; one whereof ſtands North and South, and is near 100 Yards long; whoſe Lettice-Windows reſpect North-Eaſt: the other ſide may be about 50 Yards long; the Windows look to the North, and the oppoſite ſides have no Apertures. All the Windows are about a yard high, without any Shutters, and run on in a continued *Series*, with very ſmall Partitions, ſufficient only to nail the *Lettices* to, each of them is 3 or 4 Stories high. The Ground or lowermoſt Story, 12 Foot from the Ground, is uſed only for a *Ware-houſe*, *&c.* To ſettle the firſt Story upon ſtrong Pillars, fortify'd with Spikes of *Iron*, that no Vermin might get up, would make that Story fitter for drying of Corn, and more perflatile. In ſome Places they put, in all the Inſide of their Rooms, iron *Wire* of ſo narrow *Meſhes*, that neither Rats nor Mice can get through them, 2 or 3 Foot deep. Others erect, on all the ſides, Boards of Timber, and faſten others to the top of the Perpendicular one, lying either parallel to the *Horizon*, or ſo that they make an acute Angle with the former, to the ſame purpoſe: For, beſides the devouring of the Grain, the Excrements and Urine of that Vermin, moiſtening the *Wheat* or *Rye*, make them apt to corrupt and breed *Weevels*.

The two main Conſiderables in building theſe Granaries, are, to make them ſtrong, and to expoſe them to the moſt drying Winds.

The ordering of their Corn is this, in *Kent*, to ſeparate the Duſt and other Impurities in it, when 'tis Thraſh'd, they throw it in *Shovels*, from one ſide to the other which the longer it is, the better; by which Means all ſuch Impurities remain in the middle, betwixt the two Heaps of Corns; which they skreen to part the Corn that is good, from the ſaid Impurities. Then when they bring the Grain into the *Granaries*, they lay it about half a Foot thick, and turn it twice a Week, and once in that time skreen it; and this for 2 Months ſpace. After that they lay it a Foot thick for 2 Months more, turning it once or twice a Week, and skreen it proportionably, according as the drying Seaſon is, ſeldomer or oftner. After 5 or 6 Months, they raiſe it to two Foot in Height, and turn it once a Fortnight, and skreen it once a Month, as Occaſion is. After a Year, they lay it two and a half, or 3 Foot deep, and turn it once in three Weeks, or a Month, and skreen it proportionably.

When it hath lain 2 Years or more, they turn it once in 2 Months, and skreen it once a Quarter, and ſo on, as they find it in Brightneſs, Hardneſs, and Dryneſs. The oftner theſe 2 things are done, the better the Grain proves. They leave an empty ſpace about a Yard wide on all ſides of the Room, and at 6 Foot diſtance, thro' the whole *Area*, empty of Corn, into which empty Places, they turn the Corn as often as 'tis needful.

In *Kent* they make 2 ſquare Holes in both the Ends of the Floor, and one round in the Middle; by which they throw the Corn from the upper into the lower Rooms, *& contra*, to air and dry it the better.

The Skreens are made with 2 Partitions, to ſeparate the Duſt from the Corn; which falls into a Bag, and when ſufficiently full, is caſt away, the good Corn remaining behind.

Corn has been kept in *London Granaries* 32 Years, and the longer 'tis kept the more *Flower* it yields, in Proportion to the Quantity of Corn, and makes the Purer and Whiter Bread; the ſuperfluous Humidity only evaporating.

At Zurich by Dr. *Pell*, ib.

2. Dr. *Pell* mentioned at a Meeting of the *Royal Society*, that they keep Corn at *Zurich* in *Helvetia* 80 Years.

In Dantzick *and* Muſcovy by . . ib. p. 466.

3. Obſerving Merchants and Travellers tell us, that the Granaries of *Dantzick* are generally 7 Stories high, and ſome 9 Stories; having each of them a *Funnel*, to let the Corn run down from one Floor to another, thereby chiefly ſaving the Labour and Charges of carrying it down. And then, that they in that Town, are built altogether ſurrounded with Water, whereby the Ships have the Conveniency of lying cloſe to them, to take in their Lading. No Houſes are ſuffer'd to be built near them, to be thereby ſecured from the Caſualties of Fire.

Thoſe of *Muſcovy* are made *under-ground*, by digging a deep Pit, of almoſt the Figure of a *Sugar-Loaf*, broad below, and narrow at the Top; the ſides well plaiſtered round about, and the Top very cloſely covered with Stone.

The People of that Country are ſo very careful, to have the Corn well dried, before they put it into thoſe ſubterraneous Granaries, that when the Weather of that *Northern Climate* ſerves not to dry it ſufficiently, they heat their Barns by the Means of great *Ovens*, and thereby well drying their Corn, ſupply the Deficiency of their ſhort Summer.

Turnep *and* PotatoBread, by Dr. *Beal*, n. 90 p. 5142

VIII. 1. In the Year 1629, and 1630. there was a Dearth in *England*, and much Talk they had then, that in *London* they had a way to kneed and ferment boil'd *Turneps* with a ſmall Quantity of Meal, and that it made better Bread for Whiteneſs, Pleaſantneſs, Laſting and Wholſomneſs, than is made of the fineſt Flower of *Wheat*. *Turneps*, *Rapes*, *Carrots*, *Parſneps*, *Potatoes*, and other Roots, lie ſafe under Ground from ſcorching Heat, and are ſaid to thrive beſt in the greateſt Rain. *Potatoes* were a Relief to *Ireland* in their laſt Famine. They yield Meat and Drink.

TurnepBread by Mr. *Sam.* Dale, n. 205 p. 970.

2. The Dearneſs of all ſorts of Corn in 1693, occaſion'd many poor People in *Eſſex* to make Bread of *Turneps*. The way of making it is this, They take pilled *Turneps*, and boil them in Water until they are ſoft or tender; then preſſing ſtrongly out the Juice, they mix them with their Weight of *Wheat Meal*; then adding *Salt* and *Yeaſt*, of each *q. s.* and warm Water, they knead it up as other Dough or Paſte; which having lain a little while to ferment, they order and bake it as common Bread. This *Turnep-Bread*, to the Eye is not to be diſtinguiſh'd from common *Wheaten*, or *Houſhold Bread*; neither doth the Scent much betray it, eſpecially when cold; only to dainty and nice Palates, the Turneps are a little, and but a little perceived.

The Culture of *Maize*, by Mr. *Winthrop*, n. 142 p. 1065.

IX. The Corn uſed in *New-England* before the *Engliſh* planted there, is call'd by the Natives *Weachin*, and is known by the Name of *Maiis* in ſome *Southern* Parts of *America*. The *Ear* is for the moſt part, about a Span long, compoſed of ſeveral, commonly 8 Rows of Grains, or more, according to the Goodneſs of the Ground; and in each Row, uſually above 30 *Grains*. It is of various Colours, as red, white, yellow, blue, olive, greeniſh, black, ſpeckled, ſtriped, *&c.* Sometimes in the ſame Field, and the ſame Ear. But the white and yellow are the moſt common.

The *Ear* is cloathed and armed with ſeveral ſtrong thick *Husks*, not only defending it from the Cold of the Night (being the latter End of *September*, in ſome Parts, before it be full ripe) and from unſeaſonable Rains; but alſo from the *Crows*, *Starlings*, and other Birds; which being allured by the Sweetneſs of the Corn before it hardeneth, come then in great Flights into the Fields, and pecking thro' the top of the Cover, devour as far as they can reach.

The *Stalk* groweth to the height of 6 or 8 Feet, more or leſs, according to the Condition of the Ground, or kind of Seed. The *Virginian* groweth taller than that of *New England:* And there is another ſort uſed by the *Northern Indians* far up in the Country, that groweth much ſhorter than that of *New England.* 'Tis always jointed like a *Cane*, and is full of ſweet Juice, like the *Sugar-Cane*, and a Syrup as ſweet as *Sugar* may be made of it, as hath been often try'd. And Meat ſweetned with it, hath not been diſtinguiſhed from the like ſweetned with Sugar. At every Joint there are long Leaves almoſt like Flags, and at the Top a Bunch of Flowers, like the *Bloſſoms* of Rye.

It is planted between the Middle of *March* and the Beginning of *June*; but moſt commonly from the Middle of *April* to the Middle of *May*.

In the more *Northerly* Parts, they have a peculiar kind called *Mohausks-Corn*, which tho' planted in *June*, will be ripe in Seaſon. The *Stalks* of this kind are ſhorter, and the Ears grow near to the bottom of the *Stalks*, and are generally of divers Colours.

The Manner of *Planting* is in Rows, at equal diſtance every way, about 5 or 6 Feet.

They open the Earth with an *Hoe*, taking away the ſurface 3 or 4 Inches deep, and the Breadth of the *Hoe*; and ſo throw in 4 or 5 *Grains*, a little diſtant one from another, and cover them with Earth. If two or three grow, it may do well, for ſome of them are uſually deſtroyed by Birds, or *Mouſe Squirrels*.

The Corn grown up an Hand's length, they cut up the Weeds, and looſen the Earth about it, with a broad *Hoe*, repeating this Labour, as the Weeds grow. When the Stalk begins to grow high, they draw a little Earth about it, and upon the putting forth of the Ear, ſo much as to make a little Hill, like a *Hop-Hill*; after this, they have no other Buſineſs about it, till Harveſt.

After 'tis gathered, it muſt, except laid very thin, be preſently ſtripped from the *Husks*, otherwiſe it will heat, grow mouldy, and ſometimes ſprout: The common way (which they call *Tracing*) is to weave the *Ears* together in long Traces by ſome parts of the *Husks* left thereon. Theſe Traces they hang upon *Stages*, or other Bearers within Doors, or without: For, hung in that manner, they will keep good and ſweet all the Winter after, tho' expoſed to all Weathers.

The *Natives* commonly *Threſh* it as they gather it, Dry it well on Mats in the Sun, and then beſtow it in Holes in the Ground (which are their Barns) well lined with withered Graſs and Mats, and then covered with the like; and over all with Earth; and ſo it's kept very well, till they uſe it.

The *Engliſh* have now taken to a better Way of *Planting* by the Help of the *Plow*, in this manner: In the *Planting-time*, they plow ſingle Furrows thro' the whole Field, about 6 foot diſtant, more or leſs as they ſee convenient. To theſe they plow others acroſs at the ſame Diſtance. Where theſe meet they throw in the Corn, and cover it either with the *Hoe*, or by running another Furrow with the Plow. When the Weeds begin to overtop the Corn, then they plough over the reſt of the Field between the *Planted Furrows*, and ſo turn in the *Weeds*. This is repeated where they begin to *Hill* the Corn with the *Hoe*; and ſo the Ground is better looſened than with the *Hoe*, and the Roots of the Corn have more Liberty to ſpread.

Where any *Weeds* eſcape the Plow, they uſe the *Hoe*.

Where the Ground is bad, and worn out, the *Indians* us'd to put 2 or 3 of the Fiſhes call'd *Alooſes*, under or adjacent to each Corn Hill, where they had many times a Crop double to what the *Ground* would have otherwiſe produced. The *Engliſh* alſo have learn'd the like Husbandry, where theſe *Alooſes* come up in great Plenty, or where they are near the *Fiſhing-ſtages*; having there the Heads and Garbage of *Cod-fiſh* in abundance, at no charge but the fetching.

The Fields thus plowed for this Corn, after the Crop is off, are almoſt as well fitted for *Engliſh Corn*, eſpecially *Summer Grain*, as *Peaſon* or *Summer Wheat*; as if lying fallow, they had a very good Summer-Tilth.

The *Indians*, and ſome *Engliſh* (eſpecially in good *Ground*, and well fiſhed) at every Corn-hill, plant with the Corn a kind of *French* or *Turkey Beans*: The Stalks of the Corn ſerving inſtead of Poles for the *Beans* to climb up with. And in the vacant Places between the Hills, they will plant *Squaſhes* and *Pompions*; loading the *Ground* with as much as it will bear. And many after the laſt *Weeding*, ſprinkle *Turnep-ſeed* between the Hills, and ſo, after Harveſt, have a good Crop of *Turneps*. The *Stalks* of this Corn, cut up before too much dried, and ſo laid up, are good Winter Fodder for Cattle. But they uſually leave them on the Ground for the Cattle to feed on. The *Husks* about the Ear are good Fodder, given for Change ſometimes after Hay. The *Indian* Women ſlit them into narrow Parts, and ſo weave them artificially into Baskets of ſeveral Faſhions.

This Corn the *Indians* dreſſed ſeveral Ways for their Food; ſometimes boyling it whole till it ſwelled and became tender, and ſo either eating it alone, or with their Fiſh or Veniſon inſtead of Bread; ſometimes bruiſing it in Mortars, and ſo boiling it; but commonly this way, *viz.* by parching it in Aſhes or Embers, ſo artificially ſtirring it, as without Burning to be very tender, and turned almoſt Inſide Outward, and alſo white and flowry. This they ſift very well from the *Aſhes*, and beat it in their wooden Mortars with a long Stone for a Peſtil, into fine Meal. This is a conſtant

Food at Home, and eſpecially when they travel, being put up in a Bag, and ſo at all times ready for eating either dry or mixt with Water. They find it very wholſome Diet: And the *Engliſh* ſometimes for Novelty will procure ſome of this to be made by the *Indian Women*, adding Milk or Sugar and Water to it, as they pleaſe.

The *Indians* have another ſort of Proviſion out of this Corn, which they call *Sweet Corn*. When the Corn in the Ear is full, while it is yet Green, it hath a very ſweet *Taſte*. This they gather, boil, and then dry, and ſo put it up into Bags or Baskets for their uſe; boyling it again, either whole, or groſly beaten, when they eat it, either by it ſelf, or amongſt their Fiſh, or Veniſon, or Beavers, or other Fleſh, accounting it a Principal Diſh.

Theſe green and ſweet Ears they ſometimes roaſt before the Fire, or in the *Embers*, and ſo eat the Corn; by which Means, they have ſufficient Supply of Food, tho' their old Store be done.

The *Engliſh*, of the full ripe Corn, ground, make very good Bread: But 'tis not ordered as other Corn. For if it be mixed into ſtiff Paſte, it will not be ſo good, as if made only a little ſtiffer than for *Puddings*; and ſo baked in a very hot Oven, ſtanding therein all Day, or all Night. Becauſe upon the firſt pouring of it on the Oven Floor, it ſpreads abroad, they pour a ſecond Layer or Heap upon every firſt, and thereby make ſo many Loaves, which if baked enough, and good, will be of a deep Yellowiſh Colour, if otherwiſe, white.

It is alſo ſometimes mixed with half, or a third part of *Rye* or *Wheat-meal*, and ſo with *Leaven* or *Yeaſt*, made into Loaves of very good Bread.

Before they had *Mills*, having firſt watered and husked the Corn, and then beaten it in wooden Mortars, the courſer part ſifted from the Meal, and ſeparated from the looſe Hulls by the Wind, they boiled to a thick Batter: to which, being cold, they added ſo much of the fine Meal as would ſerve to ſtiffen it into Paſte, whereof they made very good Bread.

The beſt ſort of Food which the *Engliſh* make of this Corn, is that they call *Samp*. Having firſt watered it about half an Hour, and then beaten it in a *Mortar*, or elſe ground it in a Hand or other Mill, into the Bigneſs of *Rice*, they next ſift the Flower, and Winnow the Hulls from it; then they boil it gently till it be *Tender*, and ſo with *Milk*, or *Butter* and *Sugar*, make it into a very pleaſant and wholſome Diſh.

This was the moſt uſual Diet of the firſt *Planters* in theſe Parts, and is ſtill in uſe amongſt them, as well in *Fevers* as in *Health*; and was often preſcribed by the learned Dr. *Wilſon* to his *Patients* in *London*. And of the *Indians* that live much upon this Corn; the *Engliſh*, moſt acquainted with them, have been informed by them, that the Diſeaſe of the *Stone* is very ſeldom known amongſt them.

The *Engliſh* have alſo found out a Way to make very good Beer of this Grain, That is, either of Bread made hereof, or elſe by Malting it. The Way of making Beer of Bread, is by breaking or cutting it into great Lumps, about as big as a Man's Fiſt, to be Maſhed, and ſo proceeded with as Malt, and the impregnated Liquor, as *Wort*, either adding or omitting *Hops*, as is deſired.

To make good Malt of this Corn, a particular way muſt be taken. The *Barley Malt-maſters* have uſed all their Skill to make good Malt hereof the ordinary way, but cannot effect it; that is, that the whole Grain be malted, and tender and flowry, as in other Malt. For it is found by Experience, that this Corn, before it be fully malted, muſt ſprout out both ways, (*i. e.* both *Root* and *Blade*,) to a great Length, of a Finger at leaſt, if more, the better. For which, it muſt be laid upon an Heap a convenient time; wherein on the one hand, if it lieth of a ſufficient *Thickneſs* for *Coming*, it will quickly heat and mold, and the tender Sprouts be ſo entangled, that the leaſt opening of the *Heap* break them off, and ſo hinders the further Maturation of the Grain into Malt; On the other, if it be ſtirr'd and open'd to prevent too much *Heating*, the *Sprouts* which have begun to ſhoot, ceaſe growing, and conſequently, the Corn again ceaſeth to be promoted to the Mellowneſs of Malt.

To avoid all theſe Difficulties, this way was tried and found effectual. Take away the *Top* of the *Earth* in a Garden or Field 2 or 3 Inches, throwing it up half one way and half the other; then lay the Corn for Malt, all over the Ground ſo as to cover it, then cover the Corn with the *Earth* that was pared off, and there is no more to do, till you ſee all the *Plat* of Ground like a green Field, covered over with the *Sprouts* of Corn, which will be within 10 Days or a *Fortnight*, according to the time of the Year; then take it up and ſhake the Earth from it, and dry it; for the Roots will be ſo intangled together, that it may be raiſed up in great Pieces. To make it very clean, it may be waſhed, and then preſently dry'd on a Kiln, or in the Sun, or ſpread thin on a Chamber Floor.

This Way every Grain that is good will grow, and be mellow, flowry and very ſweet; and the *Beer* made of it, will be wholſome, pleaſant and of a good Brown Colour; yet *Beer* made of the *Bread* as aforeſaid, is as well coloured, as wholeſome and pleaſant, and more durable, this therefore is moſt in uſe.

Improvements to be made by Maize, by Sir Richard Bulkley, n. 205. p. 928.

X. 1. The greateſt Profit that ever I have heard of the *Field White Peaſe*, has been 20 Barrels reap'd for one ſown; But *Maize* will yield more than 2000 for one. I made an *Experiment* in *Ireland*, with a Grappe of 8 Sides, or *Rows*, having in each 30 *Grains*, (which grew in *Brandenburg*) in good *Orchard Ground*, which had been indeed dung'd for ſome other Legumes the laſt Year, and ſow'd them in Rows; each Row being about a Yard aſunder, and each Grain about a Foot aſunder in the Row, taking Care to preſerve them from the Mice till above Ground. Now out of each Grain come up 3, 4, 5, or 6 Stems, (my *Swiſs* ſays, he rarely has ſeen above 2 or 3 elſewhere) every of which *Stems* had 4, 3, or 2 of theſe Grappes. So that we may ſuppoſe, that each Grain will give 3 ſtrong Stems, and each of theſe Stems 3 *Grappes*, and each *Grappe* 240 Grains, which makes 2160. for one.

There are ſome things very odd in the Manner of its growth, it firſt ſends up a thick *reedy Stalk*, about a Yard high, with long Leaves of a very thick woody Subſtance, and half a Yard long enwrapping the Stalk, juſt like the *Iris*. At the Top of this *Stalk*, when the Leaves open, there appear 20 or 30 Ears, as it were of our unripe *Wheat*, but this when it is opened muſt be plucked away, for it is nothing but the Flower; and what is moſt ſurprizing, the *Fruit* comes not where the *Flower* was, but on the inner ſide of every Leaf, where it joyns to the Stem, comes forth, after a time, a large *Shoot*, thicker than ones Wriſt, at the end of which hangs out a Bundle of fine Strings, like a Horſe-tail, which is the true Flower of the *Plant*. As this withers, the *Fruit* grows on within, being envelop'd in a great Number of Leaves, which when they are withered, the *Fruit* is ripe, (but is never naked while on the *Stalks*) and muſt then be taken off, and hung up to dry, or kept in Cheſts. It will ſerve for all the uſes of the *White Pea* (to which Grain it is the moſt like in Taſt and Figure) either in Bread, (with Wheat) or Soup, or Pudding, or with Pork.

2. If the *Maize* be equal in goodneſs to *Peas*, and an Acre planted with it will certainly yield more than one ſown with *Peaſe*, without impoveriſhing the Land, then indeed it will be advantageous to plant it; but if only an equal Quantity, then tho' one Grain ſhould yield a 1000 fold, all the Advantage will be in the difference of the ſeed, which is not very conſiderable; and which the Compendium of *Sowing* above *Setting* may in ſome Meaſure countervail.

Conſider'd by Mr. *J. Ray*, ib. p. 930.

By Sir *Richard*'s Deſcription of it, I am confirm'd in my Opinion, That there are two really diſtinct Species of *Maize*; for what I have ſeen cultivated in Gardens, and have my ſelf planted, ariſeth to double the Stature he aſcribes to this, that is, 7, 8, or 10 Feet; and beſides, with us, never brings the Seed near to Perfection. But that I have ſeen planted in the Fields in *Germany*, is of about the ſame Height with Sir *Richard*'s, and ripens the Seed. *Lobel* alſo acknowledges two ſorts thus differing.

XI. A Diſtiller with us (at *Newcaſtle*) hath made a Quantity of an extraordinary Spirit of *Sugar*. It ſeems to be the Reſult of ſome *anomalous Fermentation*: It is ſo ſtrong, that no Man is able to ſmell it in an open Veſſel, without being made almoſt breathleſs; neither do I think the Perſon that made it, can make it again. It was drawn from bare Sugar-water (which is nothing but the Water wherewith the Molds, Aprons *&c.* are waſhed) fermented with the Scum; and it was ſo exceedingly *Volatile*, that it would not be carried, but loſt all its Force in the Carriage, tho' it was very well ſtop'd.

An extraordinary Spirit of *Sugar*, by *Dr* Lucas *Hodgeſon*, n. 130. p. 766

XII. *Saffron-heads* planted in a black rich ſandy Mold, or in a mixt ſandy Land, between white and red, yields the greater Store of Saffron. A Clay, or ſtiff Ground, be it never ſo rich, produceth little Saffron, tho' Increaſe of *Heads* or *Roots*, if the Winter prove mild and dry; but the Extremity of Cold and Moiſture will rot them. So that the fineſt light ſandy Mold, of an indifferent Fatneſs, is eſteemed moſt profitable.

The Culture of Saffron by Mr. *Ch. Howard*, n. 138. p. 945.

Plow the Ground in the Beginning of *April*, and lay it very ſmooth and level.

About 3 Weeks or a Month after, ſpread upon every Acre 20 Loads of rotten Dung, and plow it in.

At *Midſummer* plow it again, and plant the *Saffron-Heads* in Rows, every way 3 Inches diſtant one from another, and 3 Inches deep.

The moſt expedite way of Planting, is to make a Trench the whole length of the Field, 3 Inches deep with a Spit-Shovel. The *Spit-ſhovel* is to be made of a thin ſtreight *Iron* 10 *Inches* long, and 5 Inches broad with a *Socket* in the ſide of it to put to a Staff or Handle. Lay the *Saffron-heads* 3 Inches diſtant in the *Trench*, and with the *Shovel ſpit* up 3 Inches of Earth upon them.

Obſerve this Order in *Planting* of whole Fields, whereby the *Heads* will lie every way 3 Inches one from another. Only Paths or ſhallow Trenches are to be left 2 or 3 Yards aſunder, which ſerve every Year to lay the Weeds to rot, that are to be weeded and pared off the Ground.

As ſoon as the Heads begin to ſhoot or ſpeer within the Ground, which is uſually a Fortnight before *Michaelmas*, hoe or pare the Ground all over very thin, and rake lightly all the Weeds and Graſs very clean, leaſt it choak the Flowers, which will ſoon after appear; and are then to be gather'd, and the Saffron to be picked and dried for uſe.

The Ground muſt be very carefully fenced from Sheep or Cattle, which by treading break the *Saffron-graſs*, and make the *Chives* come up ſmall.

In *May*, the *Saffron-graſs* will be quite withered away, after which the Weeds and Graſs the ground produceth, may be cut or mowed off from time to time to feed Cattle till about *Mickaelmas*, at which time the Heads will begin to ſpeer within the Ground. Then hoe, pare and rake the Ground clean as before, for a ſecond Crop. The like Directions are to be obſerved the next Year for a third Crop. The *Midſummer* following, dig up all the *Saffron Heads*, and plant them again in another new Ground, dunged and ordered as aforeſaid, wherein no *Saffron* hath been planted, at leaſt not within 7 Hours.

The Flowers are to be gathered as ſoon as they come up, before they are full blown, whether wet or dry.

Pick out the *Chives* clean from the Shells or Flowers, and ſprinkle them 2 or 3 Fingers thick, very equally on a *double Saffron-Paper*. Lay this on the *Hair-cloth* of the *Saffron-Kiln*, and cover it with 2 or more *Saffron-papers*, a piece of *Woollen Cloth*, or *thick Bays*, and a Cuſhion of *Canvas*, or *Sack cloth*, fill'd with *Barley-ſtraw*, whereon lay the Kiln Board.

Put into the *Kiln* throughly kindled, *Charcoal*, *Oven-Coals*, or the like, keeping it ſo hot, that you can hardly endure your Fingers between the Paper and the *Hair-cloth*.

After an Hour or more, turn in the Edges of the Cake with a Knife, and looſen it from the Paper. If it ſtick faſt, wet the Out-ſide of the Paper with a Feather dipt in Beer, and then dry the Papers. Turn the Cake, that both ſides may be of a Colour.

If it ſtick again to the Paper, looſen it, and then dry it with a very gentle Heat, with the addition of a quarter of 100 *l.* Weight laid upon the *Kiln-board.*

The *Saffron Cake* being ſufficiently dryed, is fit for uſe, and will laſt good many Years, being wrapt up and kept cloſe.

The *Beſt Saffron* is that which conſiſts of the thickeſt and ſhorteſt *Chives*, of a high Red and ſhining Colour, both without and within alike.

Saffron is oftentimes Burnt, and in Knots, ſpotted and mixed with the Yellows that are within the Shells.

It's uſually obſerved, that one Acre doth yield, at the leaſt, 12 Pounds of good *Saffron* one Year with another; and ſome Years 20 Pounds.

Good *Saffron* is ſeldom or never ſold at ſo low a Rate as 30 Shillings *per* Pound, frequently at 3 Pounds *per* Pound, and upwards. Wherefore one Acre bearing 12 Pounds at 40 Shillings *per* Pound, cometh to 24 Pound *per Annum.*

The gathering and Picking of one Pound of *Saffron* is worth one Shilling which cometh to 12 Shillings *per* Acre.

The Fire and care of drying may come to 3 Shillings more, at 6 Pence the Pound; which is in all 15 Shillings.

The Graſs that is Mow'd and cut off the Ground for the uſe of Cattle, will be very near worth as much as will Countervail the Picking and Drying the *Saffron*; the Soil being enriched, not only by the Dung, but the *Safforn* it ſelf, as appears by the rich Crops the Ground yields for ſeveral Years after, without any other Manuring or Improvement.

Sixteen Quarters of *Saffron-Heads* are ſufficient to Plant one Arce. A Quarter of theſe Heads is uſually ſold in the place for 10 Shillings which comes to 8 Pounds *per* Acre.

Twenty Loads of Rotten Dung laid on the Ground, may be worth 40 Shillings at 12 Pence a Load for the Dung, and as much for Carriage into the Field.

For thrice Ploughing the Ground 20 Shillings.

For Planting the Heads about 4 Pounds. Which in the whole makes 14 Pounds the Charges of Planting an Acre, which will bear 3 Crops.

So that all things reaſonably computed, it appears that an Acre of *Saffron* will be worth, notwithſtanding all Caſualties, one *Year* with another, over and above the 14 Pounds charges, for the Firſt *Years* Planting (at the leaſt) 20 *Pounds per Annum.* Beſides the great Increaſe of the *Saffron-Heads*, which will be as three for one.

The *Kiln* conſiſts of an Oaken Frame, lathed on every ſide; 12 Inches ſquare in the bottom, 2 Foot high, and 2 Foot ſquare at the Top; upon which is nailed a *Hair-cloth*, and ſtrained hard by Wedges drove into the ſides; a ſquare board, and a Weight to preſs it down, weighing about a *quarter* of an Hundred.

The inſides of the *Kiln* are covered all over with the ſtrongeſt Potters Clay, very well wrought with a little Sand, a little above 2 Inches thick.

The bottom muſt be lined with Clay 4 or 5 Inches thick, which is the

Hearth to lay the Fire on : Level wherewith is to be made a little Hole to put the Fire. The outſide may be Plaiſtered all over with Lime and Hair.

Melons order'd by M. De la Quintinay. n. 45. p 901. *Fig.* 159. XIII. The firſt thing appearing of *Melons* are two Leaves united, here call'd Ears (mark'd 11.) out of the midſt of theſe two Ears there ſhoots ſome Days after, firſt one Leaf, which call the firſt Leaf or Knot (mark'd 2) and out of the ſame place, after ſome Days more, ſhoots a ſecond, call d the ſecond Knot (mark'd 3.) out of about the midſt of the Stalk of this ſecond Knot ſhoots the 3d. Knot (mark'd 4) And this 3d Knot it is, which muſt be cut at the place mark'd 6, without hurting the Branch of the 2d Knot, whence this Third came; becauſe that from that place will ſpring a Branch, which we call the firſt Arm, and this Arm will ſhoot forth firſt one Knot, then a Second, then a Third; and this Third it is you are to cut again in the ſame manner, as was ſaid before. And you muſt be careful to cut theſe Third Knots, without ſtaying for the Shooting of the *4th* or *5th* ones. You'll ſee out of every Knot come forth Arms or Branches like to the firſt, ſpoken of before; and it is at thoſe Arms, that the *Melon* will be produced. And they will be good, if the Foot or Root be well nouriſh'd in good Earth, and cheriſh'd by a good Hot-Bed and the Sun. But let the Foot of the *Melon* never paſs into the Dung, nor the Earth be Watered but moderately, when you ſee it grows too Dry; ſo as the ſhoot might thereby ſuffer; which yet you muſt not delay, till it happen, leaſt the Remedy come too late. I Water twice or thrice a Week in very hot Weather, and that about Sun-ſet; and I cover my *Melons* with a *Straw-Mat* from 11 of the Clock in the Forenoon, to 2 in the Afternoon; when the heat of the Sun is too Violent, and too quickly conſuming that little Moiſture which is neceſſary for the Root. And when it Raineth, I cover alſo my *Melon-Garden*, leaſt too much Wet hurt my Fruit.

If the Root produce too many Branches or Arms, cut away the weakeſt of them; and leave none but 3 or 4 of the ſtrongeſt and moſt Vigorous; and ſuch as have their Knots neareſt to one another. When I tranſplant my *Melons* from the *Nurſery-bed*, I put commonly 2 Roots together, except I find one very ſtrong; which I then plant alone, cutting from it neither of the Branches that ſhoot from each ſide (mark'd 77) betwixt the one Ear and the Leaf before ſpoken of. But when I joyn two Roots together, I quite cut away both the Branches that ſhoot from the two Ears, ſtanding one over againſt the other, to avoid the diſordering abundance of Branches; which alſo would wrong the Foot.

The Melons being Knit, I leave but two of them upon each Foot; chuſing thoſe that are beſt placed, and next to the firſt and Principal Stalk, that is to the Heart of the Foot. I alſo take Care, to leave none but Fair ones and ſuch as have a ſhort and thick Tail. The Foot alſo of your Melon muſt be ſhort, well truſs'd, and not far diſtant from the Ground. Melons of a long ſtem, and having the Stalk of the Leaf too long and ſlender, are never Vigorous; and cannot yield good Melons.

It happens ſometimes, that at the very firſt, there ſhoot out from between the two Ears, two Leaves, though I above ſpoke but of one: But this happens but ſeldom, and when it does, ſuch two Leaves muſt be reckoned but for one Knot; and afterwards there will ſhoot out a ſecond, then a third &c. and ſo on to 25 or 30 if you be not careful to cut in time. And it is at the Extremity of thoſe Branches ſo diſtant, that Melons will grow: But they cannot be good, becauſe they are ſo far from the Place, which affords them their Nouriſhment.

I muſt not forget to tell you, that from the midſt betwixt the two Ears, and the two firſt Leaves, there ſhoots out yet one Branch more, which ought to be kept if Vigorous, but cut if Weak.

He that is Curious muſt every Day walk often in his Melon-Garden to cut off all the Branches, which he ſhall obſerve to be uſeleſs or hurtful.

Whenever you have a Melon, which comes well Knit on a Branch, you n. 46. p. 923 muſt not fail to cut away the reſt of that Branch, on this ſide of the Fruit: To the End that all the Nouriſhment, that would have been diſperſed into the whole Branch, may paſs into that Fruit, which is found at the Extremity of the Branch; taking care notwithſtanding, that the Fruit be covered with ſome Leaves of the other Branches, for its better Growth under the Shade, in thoſe Parts where 'tis very hot.

There commonly needs no more than 40 Days from the time of a Melon's Knitting to that of its Ripeneſs.

For the keeping of the Seed, you muſt take no other Seed but ſuch as is found in that part of the Melon, which hath been towards the Sun: And at the ſame time you Eat the Melons, you muſt well Clean ſuch Seeds, and Rub them with a Linen Cloath, until they be very clean and dry: then putting them up in ſome convenient Cloſet till Seed-time.

Remember, not to Eat the Melons but ſome 24 Hours after they have been gathered; putting them in the mean time in a dry place, neither too hot nor too Cold, and free from any dry Scents, good or ill.

Obſerve alſo, to gather them ſeaſonably, when they are neither too Ripe nor too Green which you may know by their Yellowiſh Colour, and by their Tail commonly Splitting, and their Smell. A Melon ordinarily requireth One Day from the time of its being Smitten, to that of its being gathered. I call that the Time of its being Smitten, when it begins to ſhew its being Ripe by a little Yellowneſs appearing in ſome part or other of it. A Melon that Ripens too faſt, is never good, ſuch a Ripeneſs not being a good one, but proceeding from the Poorneſs or Sickneſs of the Foot, which maketh it thus turn ſuddenly.

The Melon muſt be full, without any Vacuity, which, you know, is diſcerned by Knocking upon it. And the Meat muſt be dry, no Water running out: Only a little Dew is to appear, iſſuing out of the Pulp; which muſt be of a very *Vermilion* Colour.

Trouble not your ſelf to have big Melons, but good ones. Thoſe who covet great Melons, may have their Deſires, either by ſowing Seeds of the great kinds, or by much Watering others: Which Watering is a thing, wherein great Care and Diſcretion is to be uſed. You may judge of the neceſſity of Watering by the Vigour which is required in the Foot and Leaves, without which the Fruit cannot be good for want of good Nouriſhment.

Dog Mercury; By Mr. T.M. n. 203. p. 875.

XIV. 1. About 3 *Weeks* ago the Wife of one *W. Mathews* near *Salop* gathered ſome Herbs, and (having firſt boil'd them) fryed them with Bacon for her own and her Families Supper. And after they had been about 2 Hours in Bed, one of the Children (which is Dumb, and about 7 Years Old) fell very ſick, and ſo did the other 2 preſently after; which obliged the Man and his Wife to riſe, and take the Children to the Fire, where they Vomited and Purged, and within half an Hour fell faſt a Sleep. They took the Children to Bed as they were aſleep, and they themſelves went to Bed too, and fell faſter a Sleep than ever they had done before. The Man waked the next Morning about 3 Hours after his uſual time, went to his Labour at Mr. *Newport*'s, and ſo by the Strength of his Conſtitution carried it off: But he ſays he thought his Chin had been all the Day in a Fire, and was forced to keep his Hatful of *Water* by him all the Day long, and frequently dipt his Chin in it as he was at his Work. The Woman wakened a while after her Husband, and being forced to it, got up to look after her little Family Concerns: But ſhe was very Sick and has continued ſo till within theſe few Days; ſince which ſhe is very well Recovered. One of their Children ſlept from that Night (which was *Thurſday* 3 Weeks) till *Monday* Evening following, and then (having juſt only opened her Eyes and made two *Sprunts*, without ſpeaking one Word) dyed immediately. While ſhe was aſleep, endeavours were uſed to waken her, but in vain. The other two Children Slept about 24 Hours, and upon their wakening fell a *Vomiting* and *Purging* again, which I think ſaved their Lives. *Mathews* told me he never Eat ſo Pleaſant an Herb in his Life: But 'tis obſerv'd that the Cattle never browſe it. 'Tis branched and ſeeded like *Spinage* or *Mercury*, but leaved rathet like *Lake-weed*; the Leaves are Dented too.

By Dr. Sloan ib. p. 876.

2. Mr. *Will. Baxter* did me the favour to ſend for a dry'd Sample or Specimen, and it proves to be *Dog-Mercury*; the Stalks, Leaves and ſpikes agreeing exactly in every thing with thoſe of *Dog-Mercury* or *Mercurialis Perennis Repens*, *Cynocrambe dicta*. *J. R.*

Hemlock; By Dr. Nath. Wood. n. 231. p. 636.

XV. A Gentleman of my Acquaintance having a Horſe which was troubled with that ſtubborn Diſeaſe they call the *Farcy*, employed ſeveral uſually Efficacious Medicines inſucceſsfully. At length being in a place where grew a great quantity of *Hemlock* he obſerved the Horſe began to feed thereon greedily, eating it up. On which within 3 or 4 Days his Sores dryed up and he recovered very faſt. From whence it appears, that the Leaves at leaſt of *Hemlock* are not Noxious to ſome Animals, but rather Salutary. The Seeds alſo ſome Birds, as in our Obſervation *Buſtards*, will greedily Eat.

XVI. 1. A certain Woman near *Kilkenny* in *Ireland* eating by Miſtake ſome Root, I ſuppoſe of common *Hemlock*, among *Parſneps*, was immediately ſeiz'd with Raving and Madneſs, talked Obſcenely, and could not forbear Dancing. Thus ſhe continued for ſome time, till at length ſhe was taken with *Epileptick Fits:* Of which Diſtemper being committed to my Charge, ſhe was ſoon cured by the common Method, and has now for ſeveral Years lived in perfect Health. What Quantity ſhe eat is not known: But a piece of *Hemlock Root* was found on her Trencher.

A Poiſonous Root like Hemlock, By Dr. Nath. Wood. n. 231 p. 634.

2. I am in ſome doubt whether it was really the Root of *Hemlock*, which this Woman did Eat, and which had this Effect upon her, and not ſome other: Becauſe, 1. *Jo. Bauhine*, relating two Parallel Stories of the Effects of Roots which were taken for *Parſneps*, is of Opinion that they were the Roots of *Wild-Cicely*; *Cicutaria Vulgaris*, or *Myrrhis Sylveſtris*: Becauſe (ſaith he) the Roots of it are more like to *Parſneps*, then thoſe of *Cicuta* or *Hemlock*. 2. Mr. *Ja. Petiver* aſſured me, that he ſaw one Mr. *Henly* eat 3 or 4 Ounces of *Hemlock-Root* without the leaſt harm: Whereupon he himſelf was Encouraged to do the like, Eating about half an Ounce. They taſted ſomewhat like the Root of *Seleri*, or *Sweet Smallage:* And he perceived no Ill Effect, or Inconvenience from the Eating of them. 3. The Common People generally believe that the Roots which cauſe theſe Symptoms, are no other than *Old-Parſneps*, which have continued ſome Years in the Ground: and therefore call them *Madneps*.

By Mr. J. Ray. ib. p. 635. *Hiſt. Plant. Tom.* 3. p. [illegible]

XVII. 1. Eight Young Lads (about 30 Years ago) went a Fiſhing to a Brook near *Clonmell* in *Ireland*, and there meeting with a great Parcel of *Oenanthe Aquatica Succo Viroſo*, (in *Iriſh*, *Tahow*) they miſtook the *Roots* of it for *Sium Aquaticum Roots*, and did Eat a great deal of them. About 4 or 5 Hours after going home, the Eldeſt of them, who was almoſt of Man's ſtature without the leaſt Previous appearing Diſorder or Complaint, on a ſudden fell down backwards, and lay kicking and ſprawling on the Ground: His Countenance ſoon turned very Ghaſtly, and he Foamed at the Mouth. Soon after 4 more were ſeized the ſame way, and they all died before Morning; not one of them having ſpoken a *Word* from the Moment in which the *Venenate* Particles ſurpriſed the *Genus Nervoſum*. Of the other three, one run ſtark Mad, but came to his right Reaſon again, the next Morning; Another had his Hair and Nails faln off; and the Third (who is my Brother-in-Law, and from whom I had this Account) alone eſcaped, without receiving any harm. Whether he Eat leſs of this Fatal Root, or whether his Conſtitution, which is to this Day very *Athletick*, occaſioned it, I cannot tell; Though I am of Opinion that his ſpeedy Running above 2 Miles Home, after that he ſaw the firſt Young Man fall, together with his Drinking a very large Draught of Milk, warm from the Cow, in his Mid-way, were of ſingular uſe to him. For his violent ſweating did doubtleſs Expel and carry off many of the *Venenoſe* Particles, and had a better Effect than perhaps, the beſt of our *Alexipharmicks* (which you know are generally *Diaphoretick*) might have produced in this Caſe. Beſides, I believe, the Draught of

Hemlock-Water-Dropwort, By Mr. Fr. Vaughan. n. 238. p. 84.

Warm Milk did act its part, by involving the *Acid* or *Acrimonious Poiſonous* Particles, and rendring them unactive, and preventing their fixing the *Genus Nervoſum*, till they were expelled *per Diaphoreſin*.

There was alſo a *Dutchman* about 2 Years ſince, within 8 Miles of *Clonmel*, poiſoned by Boyling and Eating the Tops of this Plant ſhred into his Pottage. I believe he took it for *Apium Paluſtre*, which its Leaves much Reſemble.

By Mr. Ray Ib. p. 86. De Cicuta Aquat.

2. Several Parallel and no leſs Tragical Hiſtories of later Date, of the Miſerable Deſtruction of divers Perſons, by the Eating of the Roots of this Pernicious and Deleterious Plant, I find Recorded by *Jac. Wepferus*, and in the *Miſcellanea Curioſa*, *Dec.* 2, An. 6.

The Horned Poppy; By Mr. Ja. Newton. n. 242. p. 263.

XVIII. Between *Penſants* and *Marketjew* in *Cornwall*, on the Sandy ſhore grows abundance of *Papaver Corniculatum Luteum*, or *Horned Poppy*, with a yellow Flower, vulgarly called in *Hampſhire* and *Dorſetſhire*, *Squatmore*, or *Bruſe Root*, (as I was there informed) where they uſe it againſt Bruiſes External and internal. One *Charles Worth*, dwelling at the half Way-Houſe between *Penſants* and *Marketjew*, cauſed a Pye to be made of the Roots of the ſaid *Poppy* ſuppoſing them to be *Sea-Holly* or *Eringo-Roots* (for they had made Pyes thereof, which was very Pleaſant to them) but he Eating of the aforeſaid Pye, whilſt hot, was preſently taken with ſuch a kind of *Delirium*, that he call'd for a White Earthen Chamber-Pot and after having Purged by Stool into it, he broke it into pieces, and bid the By-ſtanders to ſave them, for they were all Gold, the Man and Maid-ſervants, having alſo Eat of the ſame Pye, became *Delirious*, and fanſied that moſt what they ſaw was Gold. A Child in the Cradle having alſo taſted of the Pye, was much doſed, and turned its Mouth to and again. And thus they continued for ſome Days, and then became well.

Perhaps the Yellow Colour of the Flowers running in their Minds, which the Eating of the Roots had now deprav'd, might beget that Idea of Gold in them.

The Helmontian Laudanum; By Mr. Boyle. n. 107 p. 147.

XIX. There are two ſorts of the *Helmontian Laudanum*; the one uſed by the Elder *Helmont*, the other by his Son. The former was a great Secret communicated to me by an Expert Chymiſt about 15 Years ago: Which becauſe I have not leave to Publiſh, meeting about 2 Years ago with that obliging and very Ingenious Perſon *F. M. Baron Van Helmont*, Son to the Famous *Johannes Baptiſta*, I obtained from him, by Word of Mouth, ſome Directions about the *Laudanum* he uſes; which though he confeſſed, and I ſoon perceived, to be differing from his Fathers's, yet he ſeem'd to think it not Inferiour and more Parable.

I ſoon after committed it to Writing leaſt it ſhould ſlip out of my Memory, and I had his Permiſſion to communicate it for the Publick Good.

Take of *Opium* a quarter of a Pound, and of the Juice of *Quinces* 4 Pound at the leaſt; the *Opium* being cut into very thin Slices, and then as 'twere

Mixed

Minc'd to reduce it into ſmaller parts, is to be put into, and well mixed with the Liquor, (firſt made Luke-warm) and fermented with a Moderate Heat, for 8 or 10 Days; rather more than leſs. Then Filter it, and having infuſed in it of *Cinamon*, *Nutmeg* and *Cloves*, of each an Ounce, or an Ounce and half, let them ſtand 3 or 4 Days more; if it be a full Week, it may be ſo much the better. Then Filter the Liquor once more, having let it boil a Walme or two after the Spices have been put in. This being done, evaporate away the Superfluous Water to the Conſiſtence of an Extract, or to what other Conſiſtence you pleaſe.

Laſtly incorporate very well with it two Ounces of the beſt *Saffron* reduced to fine Powder, or as much Extract as can be obtain'd from that quantity of *Saffron*.

According to the Conſiſtence you deſire to have your Medicine of, you may order it ſo, as either to make it up into a Maſs of Pills (in which Form I have cauſed it to be given) or keep it in a Liquid Form; but in this latter Caſe the Evaporation muſt have been made more ſparingly, that after the putting in of the *Saffron*, or its Extract, it may not grow too thick. In this Form the Doſe may be from 5 or 6 Drops to 10 or fewer, according to Circumſtances; and of the Pills a ſomewhat leſs quantity is required.

The Uſe of Opium *among the* Turks; *By Dr.* Edward Smith. n 231. p. 288

XX. One *Muſtapha Shatoor* an Inhabitant of *Sediqui*, a Village 6 Miles from *Smyrna*, by Trade a Coffee-Man, about 45 Years old, a moſt Famous *Opium-Eater*, told me, that his conſtant Eating was 3 Drams a Day of *Crude Opium*, one half of which was his Doſe in the Morning, and the other half in the Afternoon: But that he could ſafely take double this Quantity.

Reſolving therefore to be an Eye Witneſs of what he could do, I provided the beſt *Opium* I could get, and weighed it nicely into Drams. He came to me at my deſire, at 9 in the Morning, but excuſed his having taken half a Dram before, becauſe he wanted Strength to Riſe out of his Bed without it. I laid before him my *Opium* made up in Pills, each weighing a Dram, and deſired him to Eat what he pleaſed. He took one Dram and a half, making it up 3 in Pills, and Chewing it with a little *Water*: He commended the *Opium*, but was not willing to Eat more at that time, and I would not preſs him for fear of Accidents. He ſtayed with me about half an Hour after he had Eaten the *Opium*: The viſible Effects it had upon him were to make his Eyes Sparkle, and to give a new Air of Life and Brightneſs to his Face. He told me that he was extreamely refreſh'd by my Entertainment; and I found him half an Hour afterwards Labouring heartily at cleaving Wood to burn. At 3 in the Afternoon he came to me again, and took the ſame Quantity as in the Morning, and appeared after it with the ſame Symptoms. He ſays that it has always the ſame Effects, giving him Vigour and Spirit, and is now become as neceſſary to him as any other part of his Suſtenance; that it makes him fitter for Procreation, for he has many Wives and Children; that it never Affects him with Sleep and Drowſineſs, but rather hinders his Repoſing, when he happens to take too much of it; that he entered upon this Practice 25 Years ago, beginning with the bigneſs of a Grain, and ſo training up Nature gradually to larger Quantities; and that the want of it, and the deſire of taking more, grows daily upon him.

The Alteration and Impairment which this Cuſtom hath produced in him are Weakneſs, his Legs being ſmall; his Gums Eaten away, ſo that the Teeth ſtand bare to the Roots, his Complexion very Yellow, and appearing Older by 20 Years, than he really is.

Opium is commonly taken by the Meſſengers in *Turkey*, who are employed in making quick Diſpatches; 'tis generally part of their Proviſion, they take it when they find themſelves Tired, and it gives them Strength and Spirit to proceed. I had the following Relation of one of them, that coming from *Conſtantinople* to Mr. *Sam. Bernardiſton*, a Merchant of *Smyrna*, at entering into the Gentlemans Houſe, he fell down for Dead; at which, when the whole Houſe was ſurpriſed and concerned, one of the Servants rightly Judging that this Fainting away was occaſioned, by the Stock of *Opium* laid in for his Journey being ſpent, forced a little of it into his Mouth, and by this means he preſently Recovered, and acknowledged the Servant had been his Phyſician.

The *Turks* uſe *Opium* made up with ſomething that renders it Palatable, at their Feaſt call'd *Biram*, to make them Cheerful; which may be one Reaſon of its prevailing ſo much: For finding it then entertains them with Pleaſing Fancies, they are tempted to continue it, and ſo the uſe of it becomes neceſſary and Grows upon them.

Mackenboy; By the Bp. of Cloyne. n. 243. p. 294. XXI. The Famous *Iriſh* Herb call'd *Mackenboy*, or *Tithymalus Hibernicus*, is reported by the Natives to be ſo ſtrong a Purge, that even the carrying it about one in their Cloaths is ſufficient to produce the Effect. But Dr. *Mullen* has lately proved this Story to be Falſe, by carrying its Roots for 3 Days in his Pocket, without any Alternation of that ſort.

The Snake-Root; By Mr J. Baniſter. n. 247. p. 467. XX. The *Piſtolochia*, or *Serpentaria Virginiana* hath a Buſhy Root, conſiſting of a Number of ſmall Strings of a Yellowiſh Colour, and Hot Aromatick Scent and Taſte: Thence grow one or two ſmooth, at leaſt very little Hairy, Stalks; Round, and moſt commonly upright, not ſquare nor trayling. The Leaves grow alternately on this ſide and that, one at a Joint or Knee: They are thin long and pointed, coming like a Heart at the Foot-Stalk; a little Hairy above, and rough, with many Protuberant Veins underneath; and in handling, they ſtick a little to the Fingers. Near the Ground grow one or two hollow Flowers, each upon its proper Foot-Stalk, different in form from the *Piſtolochia Cretica*, or any other yet known: All whoſe Flowers reſemble a Cow's Horn, the Top growing to the Rudiment of the Seed Veſſel, and the open end cut flaunting like a Drenching-Horn, whereas this of ours Terminates with a Heel, which ſupports a broad, round, galericulated Lip, the Center of which opens into the hollow of the Flower.

The Lip is of a light ruſſet, or dirty Colour. The *Seed-veſſel* is *Hexagonal*, ſhap'd like a Pear, when full grown near half an Inch in Diameter. It is not an *Ever-green*, but after the Seeds are ripe, the Leaves and Stalks begin to wither and decay. It Flowers in *May*, and its Seeds are ripe in *Auguſt*.

XXIII. *Succiſa*, or *Devils-bit*, is excellent for Poyſons, eſpecially the *Plague*, and it is ſo powerful a *Sudorific*, laying the ſick Perſon, whether of the *Plague*, or other malignant Fever, on a Bed of that Herb, moderately hot, he ſhall ſweat till they take him off, and much more if he drink of the Decoction, or Juice of the Herb; which in Summer they take all, and in Winter of the Root only.

Devil's-bit, By Sir The. Mayerne, n. 211. p 166

XXIV. *Alcanna* is the Leaf of a Plant, dried and powdered; which when ſteept a Night in Wine, will die the Nails red.

Alcanna, by . . . n. 243. p. 2[illegible]5.

XXV. *An.* 1556. An *Aloë Americana Serrati Folia*, being of a pale green Colour, and conſiſting of 11 Leaves, was bound about with a red dry Cloth, and was hung up without Oyl, as is uſual, in the Kitchen. It weighed,

Aloe Americana, by *D*r. Merret, n. 25. p. 455.

		Weight				*Loſs.*				*Weight.*				*Loſs*	
		℥.	ʒ.	℈.	gr	℈.	gr.			℥.	ʒ.	℈.	gr	℈.	gr.
Aug.	4	21	6	0	2	*May*	1.	*May*	1	20	7	0	0	1	0
Aug.	19	21	3	0	24	3	27	*May*	28	20	5½	0	0	1½	0
Sept.	6	21	1⅓	0	0	1	14	*June*	12	20	4	0	4	2	26
Feb.	20	21	1	0	12	0	11	*July*	1	20	1	0	8	2	18
Mar.	16	21	0	2	0	0	32	*Jul.*	20	19	6	0	1	3	7
April	8	21	0	0	0	0	40	*Auguſt*	4	9	3	0	12	2	49

So that in a whole Year it loſt 2 Ounces, 3 Drams, 24 Grains. The ſucceeding Year, being drier and hotter, it loſt 3 Ounces 2½ Scruples, and more than double in the 6 colder, than the 6 hotter Months. I kept it about 5 Years, and it decreaſed much about the ſame Proportion. And in the Year 1660, hanging it in a colder Garret, it periſhed.

Theſe Obſervations I had about it, that every Year two of the greater Leaves firſt chang'd Colour, and withered; and in the Spring-time, there grew out two very freſh and green ones, never amounting to the bigneſs of any of the precedent. Inſomuch, that all this Time I had the ſame Number of *Leaves*. And then theſe new Leaves were more freſh and green, and not ſerrated, and thicker alſo in Proportion to their other Dimenſions. Whence perhaps it may probably be inferr'd, *viz.* from the Growth of theſe latter *Leaves*, that there's a *Circulation* in this Plant of the *Succus nutritius*: For, how is it poſſible, that the Roots continuing as firm and ſolid as at firſt, ſhould ſupply ſo much Nouriſhment, as to procreate new Leaves, unleſs it were from the Return of the ſaid *Succus*, from the old and *decaying Leaves* into the Root, and there protruded for the Production of new ones ? For all *bulbous Roots*, as *Garlick*, *Onions*, *Tulips*, and eſpecially *Squills*, who protrude their Leaves, placed in a Shop or Houſe, have their Roots lighter and more ſpungy ; the Leaves being formed out of the Subſtance of the Root, as a Chick out of the *Albumen*: In the mean while, the whole decreaſing in Weight, as in the aforeſaid *Aloe*.

The Tartarian Lamb, by Hans Sloan, n. 247. p. 461. Fig. 160. XXVI. *Fig*. 160. repreſents what is commonly, but falſly, in *India* called the *Tartarian Lamb*, ſent down from thence by Mr. *Buckly*. This was more than a Foot long, as big as ones Wriſt, having ſeveral Protuberances, and towards the End ſome Foot Stalks, about 3 or 4 Inches long, exactly like the Foot-ſtalks of *Ferns*, both without and within. Moſt Part of the outſide of this was cover'd with a *Down* of a dark yellowiſh Snuff-Colour, ſhining like Silk, ſome of it a quarter of an Inch long. This *Down* is what is commonly us'd for ſpitting Blood, about 6 Grains of it going to a Doſe, and 3 Doſes pretended to cure ſuch an *Hæmorrhage*. In *Jamaica* are many *Scandent* and *Tree-Ferns*, which grow on, or to the Bigneſs of Trees, and have ſuch a kind of *Lanugo* on them, and ſome of our *Capillaries* have ſomething like it. It ſeem'd to be ſhap'd by Art to imitate a Lamb, the Roots or climbing Parts being made to reſemble the Body, and the Extant Foot Stalks the Legs. p. 386. This *Down* is taken Notice of by Dr. *Merret*, at the latter End of Dr. *Grew's Muſ. Soc. Reg.* by the Name of *Poco Sempie*, a *Golden Moſs*, and is there ſaid to be a Cordial. I have been aſſured by Mr. *Brown*, who has made very good Obſervations in the *Eaſt-Indies*, that he has been told there by thoſe who have lived in *China*, that this *Down* or *Hair* is uſed by them for the ſtopping of Blood in freſh Wounds, as *Cobwebs* are with us : And that they have it in ſo great Eſteem, that few Houſes are without it. I have known it much uſed for ſpitting of Blood. But on Trials I have ſeen of it, though I may believe it innocent, yet I am ſure 'tis not infallible.

A ſort of *Seeds* which clarify water by *Dr.* Hans Sloan, n. 249. p. 41. Fig. 161. n. 43. p. 863. XXVII. I have ſeveral times ſeen a ſort of *Seeds*, come from the Coaſt of *Cormandel* and *Malabar*, which are there uſed for clarifying Water. They are about the Bigneſs of a ſmall *Pea*, only broader and flatter, having *Striæ* run from their Center after the Manner of the common *Nux Vomica*. The beſt Account I have had of the way of uſing them, was from Dr. *Brown*, who lived in the *Eaſt-Indies* ſome time ; he ſays, they rub or grate them on the Bottom of a ſmall earthen Baſon, wherein is contained ſome Water, this Water and Powder is put into a large Quantity of muddy or foul Water, which is by this clarified.

The true Amomum, or Tugus of the Philippine Iſles, by P. Ge. Camelli, n. 248. p. 2. XXVIII. Racemoſo *Tugus*, ſeu *Birao*, aliis *Campi*, viſo, Florum faſciculo, deguſtato ejuſdem Uvæ Acinis, ſeu oblongo Semine ; & facta collatione cum Botanicorum *Amomi* Deſcriptionibus ; *Tugus* Legitimum *Dioſcoridis* eſſe *Amomum* decrevi.

Eſt autem *Tugus* Planta quandoque ultra Cubitos aſſurgens, Folio ſimili Plantæ *Tagbac*, ſeu *Bagangbangue*, excipe quod Parte prona ſuavi obſitum ſit Lanugine: Venoſius præterea, Longius & Suaveolens. Ad Plantæ Radicem ſeu *Caulis* Truncum, ex Foliacei Caulis Meditullio Racemiformis, & Piſtillo ſeu *Amomenti* Florum Faſciculo non adeo ſimilis, prorumpit Florifera & Granigera Foliolorum ſeſquipalmaris Congeries, Floſculis exornata rubicundis, quibus Uvæ in longiuſculum procenſæ Collum ſeu Floris Tubuli Reliquias ſubſequuntur, Dulci & Pauco Cortice, unde a Muribus & Avibus una cum ſemine plerunque depaſtæ, pauca admodum & exigua colligi poteſt Quantitate. Quare & olim rarum fuiſſe, nec paſſim naſci *Virgilius* inſinuare videtur, dum ſpondet quod *Aſſyrium* vulgo naſcetur *Amomum*.

Hæ Uvæ Quina communiter, aut ſena continent Subruffa, oblonga, inæqualia, Aromatica, *Amiryong* minus Acria, & *Cubebis* Officinarum Suaveolentiora *Grana*, ſeu Acinos; ex quibus trajecto Filo, nunc per ſe nunc Sociatis *Margaritis*, ac *Corallio*, nonnullæ Puellæ *Judicæ Caropi*, ſeu *Monilia* ac *Armillas*, concinnare ſolent. Aliæ ex his, & ſemine *Bolmuſci*, iis *Maricom*; Arundinis Lithoſpermos, iis *Tigbi*; Cannæ Floridæ, iis *Ticaſticas*: Piſi *Coccinei*, iis *Saga*, *Amomonti* præterea, *Badiang*; & *Calanos Seminibus*; ſimilia nectere aſſueverunt. Ob gratum vero quem ſpirant Odorem Grana Tugus Collo appenſa gerunt, ab infecto etiam præſervare Aere, & ictui medere *Scolopendriæ*, maſticata ſi ſuperimponantur, Experientia docuit. *Radix* ſimilis eſt Radici *Tagbac* ſeu *Calami odorati* inſipida, alba interne de foris Rubicundis & ſubodoratis Cæpaceis contecta obvolucris. Ex Borongam ſcripto accepi, in Caulium apicibus alium & hunc Inodorum ferre Fructum, quem nec dum vidi. Idem *Indi Indamenſes* mihi affirmarunt: ſed eos hallucinari cenſeo, & plantam *Tacbac (Tagbac)* pro *Tugus* vidiſſe puto.

Provenit in *Borongam* & *Paranas* Caput ex aliis Inſularum *Samar*, & *Leyte* locis. Nec dubito in *Luzone* quoque reperiri, maxime *Silanii* in Torrentium profunditatibus.

Nota. Florum *Tugus* recentia & Tenella Germina, aliquantum *Pſeudo Amomum Garciæ*, *Pedem Columbinum* referens, exprimunt. Ne autem quidquam deſideretur, mitto una cum his ſcriptis Plantæ *Delineationem*; & ſimiliorem *Caſtaneam* eſſe Ovo non deerit qui objiciat, quam Folia *Tugus* Foliis Mali *Punici*, quod lubens conceſſerim. Sed quicquid *Dioſcorides* & *Plinius* de *Amomo* tradidere ſolummodo de Florigero & ſemine turgente Tugus Racemo intelligenda eſſe cenſeo; utpote quibus integra & ipſa Planta non innotuit. Hunc enim *Tugus Thyrſum* deprehendet. *B. L.* exigue fruticare *Palmi*, *viz*, pluſve minuſve Altitudine. Ex Ligno ſubruffo, ſeu lignoſa Materia, Floſculis & Folliculis *Mali Punici* ſimilibus, ſeſe in Racemi modum convolvere, ſive ut *Barth. Merula* vertit eſſe Fructum ſimilem Botruo inveniet ſemine, Uvis parvis ſimili, ſi ſeminis carnoſum ſpectet Tegumentum plenum valde odorato & Aere guſtu, vim habente calefaciendi, adſtringendi & exſiccandi, & cætera *Legitimi Amomi* ſigna, ut *Pedis Columbini* Effigiem ſi diligenter inveſtigaverit. *Amomum* in *Turcomania*, *Armeniæ* Provincia, provenire ſcribit *Joh. Botero Benes*.

XXIX. Nuperis

The Ahmella *from* Ceylon, by Dr. Hotton, n. 257. p. 365.

XXIX. Nuperis Annis magnam celebritatem nacta eſt, ob vim *Lithontripticam* quæ ipſi aſcribitur, Herba quædam a *Ceylonenſibus Ahmella* dicta. An jam uſpiam extet neſcio, ſed eam colui, cum verſarer in Præfectura *Horti Amſtelod.* Flores fundit in ſummis Caulibus perſimiles *Chryſanthemo Curaſſav elato caule flo. Aurantiis Par. Bat.* Semen ei Bidens, Caules quadrati, Fol. *Lamii* vel *Urticæ* (quæ ſubacria ſunt) conjugatis amicti; unde manifeſte liquet ad *Cannabinæ* genus, quod Bidens vocat *Cæſalpinus*, cumque ſequutus Tournefortius, ſpectare; neque forte inconcinne nuncupari poſſe *Cannabinam* aut *Bidentem Urticæ foliam Indicam Lithontripticam*.

Nux pepita, or Faba St Ignatii, by Dr. Sloan n. 249. p. 44. Fig 163. By : : : n. 250. p. 87.

XXX. 1. *Nux Pepita*, ſeu *Faba S. Ignatii*, is about the Bigneſs of a *Nutmeg*, and triangular. This Fruit is very much eſteem'd in the *Philippine Iſlands*, for the Cure of many Diſtempers.

2. 1. Habet hic Fructus Virtutes illius Metalli quod *Tumbaga* dicimus, & compoſiti illius quod *Ilingo* dicitur; proficit enim contra *Spaſmos* ac Ventos Infectos, & contra quoddam genus *Spaſmi* quod nos dicimus *Satan*.

2. Proficit ut evomatur quodcumque *Venenum*, ſi Raſuræ ejus bibantur cum Aqua frigidâ, item contra Morſus Venenatorum, ſi ſimul applicentur Morſui aliquæ Raſuræ ejus.

Item ſi aliquod Membrum laboret, *Spaſmo* proficit, ſi ſuper partem infectam applicentur ſupradictæ Raſuræ.

4. Deinde ante dictæ Raſuræ ſtagnant *Fluxum Sanguinis*, applicatæ cuicunque Vulneri. Et cum Anno præterito, 1692, daretur bibi Fœminæ laboranti *Profluvia Sanguinis* diuturno, evaſit incolumis.

5. Fugat *Febres*, nam me præſente, eodem Anno datum fuit cuidam Infantulæ laboranti intenſiſſima Febre ut biberet, & illico aufugit Febris.

6. Juvat Parientes Fœminas, ad hoc ut facilius, & felicius Creaturam expellant.

7. Venio tandem ad quotidianam Experientiam, mire proficit pro quacunque Repletione & Cruditate Stomachi, & contra proficit pro Dyſenteria & frequenti dejiciendi cupiditate temperanda.

Dividat quiſque granum in tres partes, & cum ſenſerit neceſſitatem immitat in Os per quadrantem Horæ, vel per dimidium, & deglutiat *Salivas* quæ deſtillaverint, ac poſtea bibat quaſi 2 aut 3 Uncias Aquæ frigidæ & videbit effectum.

Aliter; Quæratur Fragmentum duriſſimum Teſtaceum, ac in parte concava ponatur parum Aquæ frigidæ, & ibi refricetur Fructus, & aqua illa ponatur in Vaſcula cum Raſuris; & iterum ter aut quater fiat ſimiliter, uſque dum habeas duas *Uncias* illius Confectionis & Lotionis Fragmenti Teſtacei ac Grani Fruticis; ac poſtea revolvatur & bibat Patiens.

Item, Diviſum *Granum* in Fruſta ſi frigatur cum Oleo, (præcipue *Olivarum*) & Oleum illud bibatur, aut plagis applicetur, aut Membra *Spaſmo* laborantia cum eo unguantur, eſt Medicinale ut ſupra.

3 *Gatolongay*,

3. *Catolongay*, quam alii *Cantara* vocant, eſt Nuces Vomicas ligitimas *Serapionis* ferens Planta, quæ Arbores quaſvis altiſſimas ſeſe involvendo ſcandit. Truncus lignoſus, levis, poroſus, & brachialis quandoque Craſſitudinis, Corticiſque ſcabri, craſſi & cinerei : Folia ampla, nervoſa, amara, Folio ferme ſimilia : Florem *Balauſtia* ſimilem. Fructus inſequitur *Melone* major, qui delicatiſſima Cuticula, quæ ſplendens, Lævis & Viroris Luridi, ſeu Alabaſtrini, coopertus, ſubter quam alius Cortex deliteſcit Subſtantiæ quaſi lapideſcentis. In hoc Carne amaricante, flava & molli, qualis eſt Caro Fructus *Manga*, interjecta, noſtræ ſeu legitimæ Serapionis Nuces Vomicæ, quæ recentes ab Argentea Lanugine ſplendicant juglandis vix non pares, inæquales, variæque formæ, non raro 24 coarctantur ; quas *Indus Igaſur*, & *Mananaog*, id eſt, Victorioſas, *Hiſpanus Nucleos*, ſeu *Pepitas* de *Byſayas*, aut *Cathalogan*, alii *Fabas S. Ignatii* vocant. Hæ reſiccatæ *Avellana* Nuce cum Putamine pares, aut etiam paulo majores : Nodoſæ, duriſſimæ, Diaphanæ, & quaſi Corneæ Subſtantiæ ſunt ; Saporis Semine *Citri* multo intenſius Amari : Coloris autem inter Album & glaucum, prout & Serapio tradidit.

Syp. Gen. Camelli. ib. p. 88.

Fig. 164.

Multi, neſcio quo Oraculo edocti, Nucem *Igaſur* reticulæ Fructus *Salagſalag* immittunt, ex Collo ſuſpenſum gerunt, et ita ab omni Veneno, Peſte, Contagio, Incantationibus, Magicis, Philtris, et ſpecialiter a ſopto, ſeu Veneno quod ſolummodo inſufflatum perimere narrant, imo et ab ipſo Dæmone ſe liberos ac immunes eſſe imaginantur.

Quod *Ch. Miralles* in ſuis Collectaneis affirmat, ſcribens non tantum Virtutem habere depellendi Corporis Morbos, ſed et *malignis Spiritibus* ſpeciali quadam Oppoſitione reſiſtendi ; *Magos* etenim, *Barangas* dictos, ad præſentiam hujus Nucis inquietari, conturbari, et Sudore ſuffundi, ac ſi in neſcio quo arduo Negotio, anguſtiis periculiſque pleno verſarentur : Quod Experientia didiciſſe, inſuper et id ipſum ſibi alios fide dignos viſos affirmaſſe, addit. Unde Pactum cum Dæmone habere dictos *Barangas*, ſeu maleficos Herbarios ſuſpicatur : præſertim cum Rumor ferat, hoſce impios Medicos, ſi in Simplicium cognitione erudiri velint, Conſanguineorum proximum interimere obligari.

Alii a jam dicto *Septo*, ſeu *Toxici Inſufflamine* quo Malevoli *Indi* paſſim quos male cupiunt perimunt, *Alexium Lopez* in *Guiguan*, et *Petrum Oriol*, præter alios hacce Nuce præmunitos, ſervatos fuiſſe ferunt. Sumunt autem, uti Vulgus narrat, ſupradicti Herbarii eis familiaria et nota *Aconita*, quæ faucium latere uno recondunt, Bucca altera vero *Contrayerbas*, prout hujates loquuntur, id eſt *Antidota*, ne videlicet ſibimet ipſis Mortem maſticent. His ita ore detentis Arte, et Dexteritate Diabolica, ſibi contrarios, et infenſos viperarum more intoxicato halitu impetunt, quo perculſi ac perplexi mox humi proſternuntur, et Animam agerent, niſi eis jam experto Remedio hacce *Scil. Nuce* opem ferant. Addunt, ſi quis hanc Nucem ſecum portarit, ipſum qui ſimilibus deleteriis buccellis alterum interficere attentaverat pœnas confeſtim luere Talionis, uti *Indus*, qui *Alexium Lopez* inter fictas amicitias de medio tollere cupiens, caſualiter hanc Nucem ſecum habentem, expertus fuit, qua Occaſione primum *Hiſpanis* innotuit *Igaſur* Virtus et Efficacia. Quomodo autem naturaliter, ut nonnulli volunt, *Igaſur* Virtutem Toxici in diſtans agendo repellat, judicent alii.

Pulveris *Igaſur* ℈j. quondam *Vincentio Olzina*, temperamenti Melancholici prædito, ad Vomitum ciendum propinavi. Hic *Dyſpepſia*, *Diarrhea*, et frequenti Vomitu, cum Ructibus acidis, nec non flatuum copia moleſtabatur: Sed ſtatim ac ſumpſiſſet, tremore totius Corporis trium Horarum ſpatio perſiſtente, una cum Pruritu, et Vellicationibus *Convulſivis* horrendis ut Pedibus inſiſtere nequiverit, quæ in *Maxillis* vehementiores erant, ac magis moleſtæ, ita ut quodammodo ridere cogeretur, correptus fuit; nulla interim notabili Pulſus alteratione, Vomitu, aut alio quopiam inſequente Symptomate. De reliquo dein non nihilum melius ſenſit.

Similem tremorem, et *Convulſiones Spaſmodicas*, quas *V. Olzina* expertus fuit ſenſit et paſſus eſt *Johannes Oſaeta*, una cum ſumma Præcordiorum anguſtia, Vertigine, Animi Deliquio, et Sudoribus frigidiſſimis. Hic *Melancholico-Hypochondriacus* Sanitatis cupidus, *Nucem* recentem integram devoraverat. Cui *Oximel* et *Oleum* cum tepida exhibendo, quo plurimum Viſcoſi Phlegmatis cum Nucis particulis rejicit, opem tuli.

Joachinus Aſſim Nucis ſumpſerat partem tertiam, et ſimili modo ut *V. Olzina & Johannes Oſaeta*, ultra tres horas affectus fuit. Hic præter Motus Contractivos et Involuntarios, formicationis ſenſum, et ſpecialiter in capite expertus fuit ſimiles denique Pœnas, *A. Varaona*, *A. Girau*, et alii luere.

Vulgus autem Nucem *Igaſur*, ad cuncta abſolute Corporis Humani Mala amovenda, nulla habita Temporis, Morbi Ætatis aut Doſis ratione indifferenter exhibet et adhibet: Miraculoſque ſubſecutos affectus narrat, videlicet magnifaciendo ſuam *Panacæam*, et deprædicat Succeſſus bonos, reticens infauſtos. Nec dubium, quin aliquando a tam vehementi ſpirituum Animalium Irritatione, ac Alteratione Humorum, ab hac Nuce cauſata, Heterogenea ac Incongrua, una cum tam infeſti Medicamenti Particulis eliminentur: quibus rejectis, humoribuſque Craſſi meliori reſtitutis, Sanitas optata ſubſequatur.

Modus ordinarius et communis utendi Nuce *Igaſur* eſt, imponendo eam integram aquæ Calidæ tantillo ſpatio donec amara reddatur, exhibendo dein dictam Infuſionem. Alii Pulveris modicum in Subſtantia propinant. Alii unam alteramve offerunt deglutiendam Fruſtulam. Alii Nucem integram, *Amuleti* ritu de Collo ſuſpenſam gerunt.

Vomitum pluries cauſare ſolet, *Dejectiones* nonnunquam, Motus *Spaſmodico-Convulſivos* ferme ſemper in *Hiſpanis*; *Indis* non. In Veneni periculo, et Spirituum inordinate tumultuantium conflictu, poſthabita temporis ratione uſurpanda erit: In aliis accidentibus aut Morbis Jejuno Ventriculo in Aurora; attamen Vomitus ciendi Gratia convenientius una alterave poſt aſſumptum cibum Hora, *Doſi* ℈ſs cum aliis levioribus Vomitum cientibus exhibebitur.

Qui Nucem integram ſecum portarint, affirmant multi (fides ſit penes Authores) præſervare a *Peſte*, *Incantationibus Magicis*, *Philtris*, *Sepne*, ſeu Herbarum Venenatarum afflatu, *Aeris* præterea neſcio quo ut volunt Contagio, Hiſpanis, Malaire, & Paſmo, id eſt Stupore, *Indis Sautan* (a quo ſimiliter præſervare ferunt Corallium nigrum, Ungulam *Rhinocerotis*, *Dumbagam*, *Ingo*, & *Teſtudinis Scutum*;) *Catalepſeos* attamen Species potius eſſe videtur, eo etenim correpti Terrore veluti Panico perculſi corruunt, Senſibus & Voce privati obſtupeſcunt, mortuiſve ſæpius ſimiles obrigeſcunt; Revulſoria vero, & crudeli Muſculorum in Tibiis, ac Brachiis Flagellatione, qua Sanguis inibi aggeſtus dein *Scarificationibus* elicitur, revocantur & curantur.

Nucis fruſtulum, aut fragmentum (aut Raſuræ modicum) Viperæ Baſul (eſt Brucæ Piloſæ atque Nociferæ, ad tactum vehementem pruriginem cauſantis, Species,) aut aliorum Venenatorum Animalium morſui; Vulneri Sagitta vel alio Intoxicato Telo facto, ad impoſitum, venenum Lapidis Colubrini inſtar adhærendo extrahere communicavit *F. de la Zarza*. Alii in Hæmorrhagia Narium, & ad Sanguinem e Vulneribus profluentem ſiſtendum, Pulverem recommendant.

In Malviento, Malaire, Sautan, & Paſmo, (Catalepſeos Species eſt) Stupore, Apoplexia, Paralyſi, ſive Syderatione, Lethargo, Epilepſia, Morbo Caduco, Aſtmate, & Catarrho Maligno ac ſuffocante, Dentium Dolore, & aliis Defluxionibus, fruſtellum ſupponitur Linguæ, Apophlegmatizandi gratia: ita enim Caput a copia Viſcoſi Phlegmatis liberatum, Ægri pluries levamen percipiunt, & ſæpius jamjam Agonizantes, ut ita dicam reſuſcitentur, & aut Confiteri, aut alia quæ pro tunc conveniunt declarare, valent.

Pulverem, aut infuſum, aut Oleum infra deſcriptum, propinant & dilaudant in Febri Tertiana & Quartana. Veneni periculo, aut ſupradicto Sopto, Buyaſſò, (eſt Buyo, ſeu Betele, confectio mortifera, cum Semine ut opinor, Stramonii, aut ſimili Narcotico, quæ ſi aſſumptæ non perimit, Hominem perplexum, Attonitum, Hebetem, Stupidum, & Torpidiſſimum reddit; ab hujuſcemodi dico Confectione devorata, aut Maſticata, infra poſito *Oleo* curata fuiſſe ſcio, & *Botete Sardina* Nocivæ comeſtæ Suſpicione.

Ad Urinas item, Menſes & Puerperia ſuppreſſa provocanda, Partum difficilem facilitandum, Secundinam, Fœtum Mortuum & Lumbricos expellendos, efficacem reperi. In Dolore Colico præterea, Cibi Indigeſtione, Cruditate Ventriculi & Concoctione Læſa, Diarrhæa, Teneſmo, & Obſtructione Epatis, ac Lienis, uti & in omnibus ſupra enumeratis Morbis, exhibent.

Oleum vero ex *Igaſur* ſimpliciter infuſione paratum *Emeticum* eſt efficaciſſimum; valet ad eadem ad quæ *Nux* ipſa; hoc ad Magi *Barang* præſentiam Efferveſcere, & Vaſe quo aſſervatur exilire, vir retulit fide Digniſſimus. Idem & alii in ſuis Scriptis affirmant.

Hoc *Oleum* alii efficacius reddere cupientes componunt, ex *Igaſur*, *Tambal de Garigara*, *Tambal de Sangil*, *Tambal de Bornei*, *Salagſalag*, *Camaeſa*, *Manungal*, *Alagao*, *Salibutbut*, *Tambaliſay*, *Marbar Molavin*, *Borogtongon*, *Palyaccan Panambuc*, *Pancoro*, *Noladaſſon*, *Bagatapon*, *Oringin*, & aliis; vulgo *Jazeite de Tambal*, a Cortice *Scil. Emetico Mananangtang*, appellatur, violenter Purgat, per Superiora, & Inferiora; *Doſis* ℥j. ʒij.

Lignum Sanctum Luzonis Guajaco utiliter ſubſtituitur; de reliquo Con-coctionem adjuvat, & Dejectam Ciborum excitat appetentiam. *N. B. Pregnantibus* exhiberi non poteſt, quin *Abortum* patiantur.

Lignum Colubrinum Manungal, Decoctum ejus, venenis omnibus, venenatorumque Animalium morſibus, ſuccurrit; *Febriſugum* eſt, & *Anti-Aſtmaticum*, Obſtructiones inveteratas reſerans, & Abjectam Ciborum reſtaurans appetentiam; *Ictero* præterea, octo dierum ſpatio in aurora hauſtum medetur. *Lumbricos* pellit, & Cholicos Dolores mitigat. Decoctum ex ℥ij. paratum, Dejectiones ferme quinas cauſare ſolet.

Cortex Vomitorius Manangtang, datur in pulvere a ℈j. ad ℈ iv. Pituitoſa & Lenta, nec non Bilioſa, per *Vomitum* & *Seceſſum* potenter evacuat: Unde in Febribus, ventriculi repletione aut ex humoris Viſcoſi turgeſcentia, *Cachexia* & *Hydrope*, feliciter exhibetur. In omni Veneni periculo c, decocto Manungal, & ad Ventris Lumbricos educendos, plurimum facit.

By Dr: Hotton. n. 257. p. 365. 4. Noviſſime increbuit Uſus Fabæ, quam vocant, *di S. Ignatio*; dicitur & *Higoſur*, & *Faba di S. Nicholas*, & de *Cava Longa*. Semen eſt Amariſſimum, quod nullam Fabæ præ ſe fert Similitudinem, ut ex ipſo Semine videbis. Ad movendos Sudores & debellandos Febres præcipuum creditur: & *Diarrhea*, *Dyſenteria*, *Colicis* Doloribus, Motibus Convulſivis, ipſique *Epilepſia* mederi; & externe admotum, *Scabiei*: celebratur cum primis & ejus Virtus *Alexipharmaca*. Provenit in *Philippinis*, quas vocant, iiſque vicinis, Inſulis. Cujus Generis Stirps ſit ignoratur; id tantum didici ex *D. Rafaele de Roa*, *Hiſpano* viro Egregio & Erudito, qui in iis Inſulis diu vixit, convolvulaceam eſſe plantam Arbores altiſſimas ſcandentem, fructumque ferre *Mali Punici* magnitudine, quo complura Semina reconduntur, ex quibus Deciduis novæ plantæ ſubnaſcantur.

Cherry's Recovered though almoſt Withered By Dr. Char. Merret. n. 25. p. 455.

XXXI. I had three *May* Cherry-Trees, Planted in a Rich Mould, which lay to a South Wall, ſhaded from the Sun by a high Building, till the beginning of *March*; when being high, and ſhining ſomewhat fiercely upon them, the Fruit conſtantly Wither'd. But this Year, 1665, the Seaſon being very Hot and Dry, I bared the Roots of one of them, by making a hole about it, and watered it every Morning and Evening with about a Gallon of Water, for about a Fortnight before the Cherries came to Redneſs, and the Fruit was full and good. The other two Trees, left without this ordering, had moſt of their Fruit Withered; having only Skins and Stones. Then I made a hole round about one of the other Trees, and fed it with Water daily, as the former: In a Week's time, thoſe that were quite Withered fell off, and the reſt that were not ſo, grew and increaſed exceedingly; the other Tree, that was not uſed after this Manner, had not any of its Fruit come to Perfection.

The Sorbus Pyriformis, By Mr. Edm. Pitt. n. 139. p. 97

XXXII. I have lately found the *Sorbus Pyriformis* of *L'Obelius* or *Sorbus Procera* of *Bauhinus* growing wild in a Foreſt of *Worceſterſhire*. It reſembles the *Ornus* or *Quicken Tree*; only the *Ornus* bears the Flower and Fruit at the End, this on the ſides of the Branch. Next the Sun, the Fruit hath a dark Red

Bluſh; and is about the bigneſs of a ſmall *Juneting Pear*. In *Sept.* it is ſo rough as to be ready to Strangle one: But being then gathered, and kept till *October*, they Eat as well as any *Medlar*.

2. Perhaps a *Verjuice* made of this Fruit, either ground with Crabs, or Grapes, or if plentiful, alone, would, being kept for ſome time, prove one of the beſt *Acid-Aſtringent Sauces*, that Nature affords. *By . . . ib. p. 979.*

XXXIII. The laſt Autumn I met with a Double Pear. One part growing over, and being fixt in the other; not unlike an Acorn in its Cup. From the Edges of the lower Pear there grew up 5 Leaves of various Magnitude, at diſtances almoſt equal from each other. The largeſt of them was one Inch long, half an Inch broad; as large again as the ſmalleſt Leaf. Theſe Leaves grow out of the Skin of the lower Pear, and had no Fibres riſing from the Carnous part of it. One of the Leaves, the largeſt of them, had a Fibre of the bigneſs of a ſmall Hair, continued from the place where the Leaf riſes down, juſt within the Skin and looſe from it, to the *Pedunculus*. The Outer Coat of the *Pedunculus* was continued to the Skin of the lower Pear, and this Skin to that of the upper Pear. The Inner Fibres of the *Pedunculus* go through the lower up into the upper Pear, and diſperſe themſelves in it. The upper Part was twice as beg as the lower, and had ſeveral Kernels in it, but the lower none at all.

A Double Pear; *By . . .* n.260. p 470.

XXXIV. I have Planted here (in *Virginia*) 10000 *Mulberry Trees*; and hope within 2 or 3 Years, to reap good Silk off them. I have Planted them in a way unuſual here, which advances them two or three Years Growth, in reſpect of their being Sown in Seed. I intend likewiſe to Plant them all, as if they were *Currents* or *Gooſberries*, ſo thick as Hedges. By this way of Planting them in Hedges they will be always young tender Plants; and conſequently will be eaſily cut in great quantities with a pair of Garden Sciſſors: Whereby one Man may gather as many of them, as otherwiſe, when they are Planted in Trees at diſtance, 4 Perſons can do. But perhaps it may be a better way to Sow ſome Acres with *Mulberry-Seed*, and to cut it with a Sith, and ever to keep it under.

An unuſual way of Propagating Mulberry Trees, *in* Virginia, *for the* Silk Work; *By . . .* n. 12. p. 203.

XXXV. The Vulgar Husbandman (without the Expences, Curioſity, Care, or Trouble of Grafting) may Propagate the *Genet Moyles* by the Knotted Branches alone, in Ground that deſerves not to be called *Fertile*; as they do in the *Rye-Land*, and *Gorſty* Ground in *Wales*; and the *Cyder* made of the Fruit, which when perfectly Ripe hath a peculiar Fragrancy, is delicately Agreeable to tender Palates, till the heat of *July* does too often alter the Caſe.

Choice of Fruit Trees, *for* Speedy Propagation *and* Pleaſant Liquor; *By Dr.* J Beal. n.71. p.2146.

There is a *Summer-Apple* call'd *French Cornel*, early Ripe, and very richly full of a moſt Pleaſing Liquor, which I dare Extol for a moſt Delicious Beveridge before the ordinary time for *Cyder* comes in. 'Tis a ſmall Tree, all the Branches criſped, and curled full of Knots at very turning, and apt to grow by any Branch that is cut off below the Knot. It proſpers beſt in a good Mould, better than that of the Commom Field; yet in the dry *Rye-land* it bears Plentifully every ſecond Year, and when one of theſe Trees fails, the next of the ſame kind may have a full Burthen.

Some Soil which doth hardly bear Apples, does moſt kindly bear Pears; and there is a great variety of Pears to humour every Palate. In the Confines between *Worceſter* and *Hereford*, from *Pawick* to *Bosbury*, the *Bare-land-Pear* grows in the Common Arable Field. That, and ſome other Pears of uncertain Names, in *Powick* do yield a very ſtrong and long laſting Liquor. The *Horſe-Pears*, as there they call them, the White and Red of ſeveral kinds, yield abundance of pleaſant Liquor. The *Ailets*, great and little, wild and gentle, the *Linton-Pear*, *Lullam-Pear*, *Squaſh-Pear*, have their peculiar Excellencies for Liquor, and ſome of them for the largeneſs of the Tree; yielding conſtantly ſome Hogſheads of Liquor yearly.

Where the Soil hath not been tryed and found kindeſt for Apples, 'tis the ſureſt way to Plant Pears alternatively, and where the Liquor of Pears is weak, or leſs laſting, this may be helped by a gentle Mixture of Crabs, or of the harſheſt Apples, to humour all Palates, and for a help to the Stomack, the Mixture being made in the time of Grinding the Fruit together; And thus, when the better Soil is too ſhallow for Apples, but receives Pears kindly at a greater Depth, a Hedge-row of Crabs, or wild Auſtere Apples, raiſed on the Mounds, and Ripening in the ſame Seaſon, will by well ordering it, afford ſuch a perfect Remedy, that judicious Palates may be deceived, and take it for the beſt *Cyder*. Sir *W. S.* recommends the *Hamlin-Apple* of *Devon* for *Cyder* equal to the beſt, if not excelling.

An Eaſy Way of Raiſing Fruit Trees, By Mr. Lewis, n. 95 p. 6067

XXXVI. Take a Piece of the Root of any *Apple-Tree* or *Pear-Tree*, *&c.* about 6 Inches long, and *Tongue Graft* a Graft of an Apple or Pear into the Root. The way of *Tongue grafting* is, to cut the Root ſloping about one Inch, and the *Graft* ſloping in like manner one Inch, cutting both very ſmooth. Then Cleave the Root and the *Graft* likewiſe about one Inch, and enter them into one another, that the *Sap* of the *Graft* may joyn to the *Sap* of the *Root*, as much as you can. Lap the joynted place about with a little Hemp or Flax-hurds; ſet the Root ſo grafted into the Ground about 10 or 12 Inches deep, ſo as the Joynt may be covered at leaſt 4 Inches under the Earth, that it may not be bared at any time, but kept moiſt by the Earth.

The *Root* you *Graft* upon, muſt not be leſs than your *Graft*; it is no In convenience if it is bigger; But it is beſt that the *Root* and the *Graft* be o the ſame bigneſs.

About 29 Years ſince I Sowed a Bed of *Apple Kernels* in *March*, The Sprig following I pluck'd up 40 of thoſe *Seedlings*, grown to the thickneſs of a Fai *Graft*; I *Grafted* them in this manner of *Tongue-Grafting*, and Planted the again. They all grew, and 4 of them bore Fruit to Perfection that Year; ſ that in a Year and half from an *Apple Kernel* I had Ripe Fruit. Some of the Trees will now bear 2 Quarters of Apples upon a Tree; and are bigger tha

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moſt of thoſe Trees amongſt which they ſtand, which coſt 12 *d.* the Tree when theſe were *Kernels.*

I conceive that *Plumbs*, *Cherries*, *Apricocks*, *Peaches*, and all ſorts of Fruit Trees may be thus raiſed.

XXXVII. 1. I never begin to plant till *Valentine*'s *Day*; and I approve of late planting before early; the Cold in the *Winter* kills more than the Drought in Summer. We impute it indeed to the Drought, becauſe they languiſh until *Summer*, and then die: But they receive the fatal Stroke by the Cold in *Winter*.

The beſt ſeaſon of tranſplanting, by Mr. R. Reed, n. 70. p. 2130.

For either we take our Stocks out of *Woods*, or out of Nurſeries; in either Place they lie warm, and if you tranſplant them in *October*, you expoſe 'em on a ſudden to an open Air, and adventure them, being weak, to a long and perhaps cold Winter, which they cannot bear. Add hereunto, that I can relieve them againſt the Drought, by Watering and Covering the Ground, to keep it cool: But there is no Fence againſt the Froſt, which many times gets into the Roots, and kills, ſo that they never ſpring; or if they do, yet Pulingly, and die in the Spring, or if they ſurvive, as many do, yet come on very ſlowly and pitifully. For the *Bark* does cleave to the *Wood* by Reaſon of the Cold, which dries and clings them together, that like an *Hide-bound Horſe*, they will not admit the Sap, which the Root would ſend up; and other *Suckers* grow out of the Earth; and the Tree grows dry, and turns Red: All which diſcovers the Obſtruction in the Receiving the Sap, which would come from the Root, and then we are forced to ſcore and looſen the *Bark*, as we can. Now on the other ſide, if the *Summer* proves moiſt, the *Danger* and *Fear* of late Setting is over, and they will *Thrive* and come forward amain; if otherwiſe, I ſeldom ſee but they always keep *green* and *freſh*, being maintained in *Life* and *Verdure* by the *Sap* they receive in the Beginning of the *Spring*, before they be *tranſplanted.*

This therefore I do (which I ſubmit to better *Judgments* and *Experience*;) In the dead of *Winter*, I prune and cut the *Tree* I intend to *Tranſplant*, as I would have it be, to the End to loſe Nothing of its *Strength* when I *tranſplant.* Then I ſuffer it to abide untouched by the Spade till *Valentine*'s Day, and then remove it after it hath taken in ſomewhat of the *Spring*. I am very careful to preſerve and ſet the Roots as large as I may; ſuppoſing the *Larger Root*, the more of *Strength* and *Sap* it contains, and ſo will advance the more the Growth of the *Tree*; ſince every thing grows in *Proportion* to the *Root* beneath. But I have heard from ſome *Planters*, who had *Experience* therein, that Roots cut ſhort do beſt, as ſending forth new Roots, which draw *Sap* and Nouriſhment beſt. And we ſee that *Moyles* ſet on Slips, that have no Roots, come to a *Tree* ſooneſt, and I have oft obſerved, that a *Moyle tranſplanted* after it hath taken Root, does not live ſo certainly, or thrive ſo well as a Slip newly ſet.

2. Dr. *Lauremberg*, a Perſon of much *Experience*, agreeth with Mr. *Read*, that Plants which cannot well bear the Hardſhip of the *Winter*, ſhould be

By Dr. J. Beal. n. 71. p. 2148.

Tranſplanted in the *Spring*; but that ſuch as are able to bear the Extremity of a cold *Winter*, ſhould be *tranſplanted* in *Autumn*. In this only he differs, That he ſaith *Poma, Pyra, Ceraſa vulgaria, Coryli, Oxyocanthi, Pruna, &c. facile Frigus ferunt, & Autumno Tranſplantari optimo ſucceſſu ſolent*; and then for the *Spring*, he refers *Juglandes, Perſica, Abricoca, aliquot Ceraſorum Genus.* And I think, where he wrote and practiſed, it is as cold a Country as *England.* I ſhall only add, that 'tis an old *Engliſh* and *Welſh Proverb*, concerning *Apples, Pears*, and the *Hawthorn Quick, Oaks, &c. Set them at* Allhallontide, *and command them to proſper*; *ſet after* Candlemas, *and intreat them to grow.*

Laurenb. de Hort. Cult. l. 1. c. 28.

Bloſſoms do not forthwith diſcover a Blaſt, by Dr. Beal, n. 23. p. 424

XXXVIII. It is to be noted, that the *Bloſſoms* of *Fruit-trees* do not forthwith diſcover the Blaſt, for an old experienced Country-man having once given me Notice of a *Blaſty* Noon, (it being then ſultry Weather, and ſomewhat gloomy with the Thickneſs of Exhalations, almoſt like a very thick Miſt, and within a Day or two, ſhewing the Proof upon the *Cherry-bloſſoms*, then flagging, but not much altering their Colour till two Days more were paſt.

Cyder, by Mr. R. Reed, n. 70. p. 2128

XXXIX. 1. I do commend for the advancing of *Cyder* in Richneſs, both for Taſt and Colour; a new *Cask*, provided it be made of Timber very well ſeaſoned; otherwiſe it may ſpoil it utterly. I have often tried it, and found that ſort of *Cask* to improve the *Cyder.*

The beſt *Cyder*, I ever had, was *Redſtrake* grafted upon a *Gennet Moyle-ſtock.* For, as thoſe kinds do beſt agree, and the Trees ſo grafted ſeldom *Canker*, (as do the old *Redſtrake* upon a *Crab-ſtock*) ſo the Fruit is far more ingenious and milder; and being ripe, both rich and large, and good to eat; and the *Cyder* is more ſmooth, and abates in Strength and Harſhneſs of that on the *Crab*; and needs leſs of Mellowing before making; the Stock in Degree altering and reclaiming the Nature of the Fruit. For, as an *Apple* doth beſt grafted on a *Crab*, which gives Acrimony and Quickneſs to the Fruit, ſo a *Crab*, and a *Redſtrake* is no other, grafted on an *Apple*, receiveth thence Gentleneſs and Softneſs, and Largeneſs, and an excellent Alloy to the Sharpneſs, and (as Mr. *Evelin* calls it) the *Wickedneſs* of the Fruit.

An excellent *Drink, from* Apples and Mulberries, by Mr. *Sam. Colepreſs*, n. 27. p. 501

2. A Compoſition of the Juices of good *Cyder-Apples* and *Mulberries* produceth the beſt taſted and moſt curiouſly coloured Liquor, that many ever ſaw or taſted.

Vines, by Mr. J. Templer; n. 93. p. 6016.

XL. I have lately ſeen a pretty and pleaſant Culture of *Vines*, at the Houſe of a Gentleman, who makes very good *White-Wine* of his own *Grapes*: He lets *Vines* aſcend by one ſingle *Stem* to the *Eaves* of his Houſe (cutting off all the luxuriant Branches by the way) then gives them liberty to ſpread upon the *Tiles*, all over one ſide of the Roof of his Houſe. Thus he furniſhes his Dwelling-Houſe, and many Out-houſes; by which Means, the *Vines* are no Hindrance to his other *Wall-Fruit*, and the Rays of the Sun being almoſt ect upon the Vines, he hath Riper, ſweeter and greater Plenty of Grapes, than when their Vines are placed as Wall Fruit.

XLI. At *Frontignac*, they let the Grapes grow half Dry upon the Vine, and as ſoon as they are gathered, they Tread and Preſs them immediately, and tun up the Liquor, without litting it ſtand and Work in the Fat, the Lee cauſing its goodneſs. Thus is made the true Genuine *Muſcadine*, without mixing any other ſort of *Grape* with it. Lately a certain Perſon thought fit to paſs *White-Wine* of another kind upon the Mark or Husks (which are wont to be caſt away) of the *Muſcadine Grapes*: And hath made in this manner an Excellent Wine, which hath the Taſte of *Muſcadine*, and is more Pleaſing to ſome, nor is ſo heady, as the Franc or True *Muſcadine*.

To make Muſcadine Wine; *By* M. de Martel. n. 58. p. 1183.

XLII. They take two great Casks, within each of which they put at the bottom a *Trevet*, which muſt be one Foot high, and as large as the largeneſs of the Cask permits. Upon this *Trevet* they put *Vine-Twigs*; whereon they lay a ſubſtance called *Rape*, with which they fill both Veſſels, within half a Foot from the Top. This *Rape* is nothing elſe, but the Wood or Stalks of the Cluſters of *Grapes* dryed and freed from the *Grapes*. The *Trevet* and the *Vine Branches* are put at the bottom of the Casks, only to keep the *Rape* from the ſettling at bottom. It is this *Rape*, which alone Heats and Sowers the Wine. The two Veſſels being almoſt quite fill'd with the *Rape*, one of them is fill'd up with Wine, and the other only half full for the time; and every Day they draw, by a Cock, half the Wine, that is in the full Veſſel, therewith quite to fill up the other, that is but half full; obſerving Interchangeable turns of filling and unfilling the Veſſels. Ordinarily, at the end of 2 or 3 Days, the Half-fill'd Veſſel begins to Heat, and this Heat Augments for ſeveral Days ſucceſſively, continuing to do ſo till the Vinegar is perfectly made; and the Workmen know, that the Vinegar is made, y the ceaſing of the Heat. In Summer it is a Work of 15 Days: In Winer it proceeds more ſlowly; and that according to the degree of Cold Weaher.

The way of making Vinegar *in* France; *By* M———. n 61: p: 2002:

When the Weather is hotteſt, the *Wine* muſt be drawn twice a Day, to ut it out of one Veſſel into the other. It is only the half fill'd Cask that eats, and as ſoon as you have done filling up, its Heat is Choaked and opped for the time, and the other Cask, which is unfill'd, begins to Heat.

The full Veſſel is quite open at the top; but a Wooden Cover is put on e Veſſel, that is but half-full.

The beſt *Wine* makes the beſt Vinegar; but yet they make good Vinegar Wine that is turned.

The *Wine*, in changing leaves a certain Greaſe, which ſticks partly to the es of the Cask (and that they take care to do Clean away) and partly the *Rape*; ſo that if they Cleanſe not the *Rape* from it, almoſt every ar once the *Wine* turns into a Whitiſh Liquor, which is neither Wine Vinegar.

At the time when they pour the Wine out of one Veſſel into another, Scum ariſeth on the top of the Veſſel, which muſt be taken carefully away.

In the Casks, which have never ſerved for this purpoſe before, the *Vinegar* is made more ſlowly, than in ſuch as have been uſed already.

ib. p. 2034. The *Rape*, as ſoon as 'tis ſeparated from the *Grapes*, (which is done immediately after *Vintage*) is carefully put up in Barrels, leaſt it take Air; without which it would Heat it ſelf and be ſpoiled.

There is no other way of keeping the *Rape* that hath once ſerved already, than to Drown it; that is to ſay, to fill the *Veſſel* wherein it is with *Wine* or *Vinegar*. *Rape* will ſerve a Year, more or leſs, provided care be taken of Cleaning every Morning, with a piece of Linen, the *Greaſe* that is on the ſides of the *Veſſel*; and with a little Broom, that which Swims on the top of the Liquor. The *Rape* may be freed from its *Greaſe* with Water, rubbing it between ones hands. No body, that I know hath hitherto examin'd what this *Greaſe* [illegible].

I have been lately informed, that there have been Merchants here, who made *Vinegar* with *Phlegm* of *Wine*, remaining after that the *Aqua Vitæ* is extracted from it.

Orange Trees; *By*.. n. 29. p.554

XLIII. A *Provencal* at *Paris*, pretends to keep *Orange-Trees* in that Town all the *Winter* long without any Fire, though they remain in the Earth, and not be put in Caſes or Boxes. This is thought to be effected by a peculiar ſort of Dung uſed for that Purpoſe, and wrought deep into the *Ground*.

One Individual Fruit *half* Orange *and half* Limon; *By*. n 29. p.453. By Mr.., ib

XLIV. 1. We have *Orange-Trees* at *Florence* that bear a Fruit which is *Citron* on one ſide, and *Orange* on the other. They have not been brought hither out of other Countries, and they are now much propagated by *Engrafting*.

2. A very Ingenious *Engliſh* Gentleman aſſerts that himſelf not only had ſeen, but bought of them *An.* 1660. in *Paris*, whither they had been ſent by *Genoa Merchants*; and that on ſome Trees he had found an *Orange* on one Branch, and a *Limon* on another Branch, as alſo (conſtantly to the *Florentine* Information) one and the ſame Fruit half *Orange* and half *Limon*; and ſometimes 3 Quarters of one kind, and one Quarter of the other.

By Pet. Naſcus: n 114 p. 313.

3. About 30 Years ſince a *Tree* was firſt met with in a *Grove* near *Florence* having an *Orange* Stock, which it ſeems, was ſo grafted upon, that thence it became in its Branches, Leaves, Flowers and Fruit, three formed; ſome Emulating *Orange*, ſome *Limons* or *Citrons* ſome partaking of both Forms in one. And particularly as to the Fruit, ſome of this Tree are meer *Oranges*, yet ſome of them of an Oblong Shape like *Limons*, ſome Round like common *Oranges*, ſome between both: Others taſte like Genuine *Oranges*, others have an *Orange* Shell, but a *Limon* Pulp. Moſt are of a very ſtrong Scent, and a Shell of a very bitter Taſte. But then the ſame Tree bears alſo a kind of *Citron Limon*, yet not ſo many as of the former kind. And not only ſo, but it produces alſo a Fruit, that is in one both *Limon*, *Citron*, and *Orange*; ſo that you may ſee outwardly two ſorts of Fruit repreſented in one Piece; one *Citron Limon*, the other *Orange*. But this Fruit is ſo diverſified, that ſome of them are half *Citron-Limon*, half *Orange*; others have Two-thirds of *Citron-*

Limon and one of *Orange*, others the contrary: And of all theſe, ſome are Oblong, ſome Round, ſome Bunchy, ſome Smooth, ſome Rugged, ſome Small, ſome of the bigneſs of two Pound Weight. Their Fleſh is ſo diſtinguiſh'd, that where the *Orange Pulp* Ends, that of *Limon* begins, and on the contrary. Again, the *Orange Pulp* is Narrower than that of *Limon*; but this is tenderer than that, not ſo agreeable to the Taſte, as the genuine ſingle Fruit. They have either none, or very few, or empty Seeds: Nature, it ſeems, ſince this Tree is of the *Inſititious kind*, nor can be repaired or propagated by Seed, is not at all ſollicitous in the generation of them.

The firſt Original of this Tree was by *Inoculating Orange* upon a *Citron-Limon-Stock*, ſo that by the Marriage of theſe Trees, repeated for many Years, it was come to paſs, that by the cloſeneſs of the *Inoculation*, whereby in length of time the mixed Nature of both Trees was grown together; which the different Juyces, permeating the common Fibres, had for a long time nouriſhed: Whence Emerged at length a *Germen*, or *Graft*, perfectly retaining the Nature and Species of both; into whoſe different Branches when ſometime one, ſometimes both kinds of Juyces did paſs, it produced on one of thoſe Branches, a meer *Orange*, on another a *Citron-Limon*, on a third a *Citron-Limon-Orange*, and even ſometimes upon one and the ſame Branch, all the three ſorts of this Fruit together.

An Account of the Coffee Shrub; By *Dr.* H. Sl an. n. 208. p. 63.

Fig. 165

XLV. Mr. *Edw. Clyve* (and he is the firſt) who brought a dry'd Branch of the *Coffee Shrub* AA. from *Moha* in *Arabia-Felix*, gives this account of it. This Branch was taken off a Tree 7 or 8. Foot high, is about 5 Foot long, and covered with a Gray almoſt ſmooth Bark. The Wood is White, and the Pith not very large, the Twigs are covered with a Darker-colour'd very ſmooth Bark, and riſe Oppoſite to one another by *Pairs*, ſtanding Croſs to one another coming out of Oppoſite ſides of the Branch, or the two *Pairs* next to one another cutting each other at Right Angles. After the ſame manner ſtand the Leaves on the Twigs, as the Twigs on the Branches, at ſometimes an Inch, and ſometimes two Inches diſtance, each Pair of Leaves from the other one. The Leaves have ¼ Inch Foot Stalks, being about four Inches long, and two broad in the middle where broadeſt; whence they Decreaſe to both Extreams, ending in a Point. They are ſmooth, whole, and without any *Inciſures* on their Edges, ſomewhat like the Leaves of a Bay. The Fruit comes *ex Alis Foliorum*, hanging or ſticking to the Twig by ¼ Inch long Strings or Foot-Stalks; and ſometimes one, two or more, at the ſame place.

Theſe Shrubs are Planted in *Arabia Felix*, call'd *Jaman*, every where in a rich Ground or Mold in great Plenty, and are Watered in times of Drought as other Cultivated Vegetables there, by Artificial Channels from Rivers cut on purpoſe to Nouriſh them; and after three, four or more *Years* Bearing, the Inhabitants are forced to Plant New Shrubs, becauſe the Old ones become not ſo Fruitful after that time. They dry them in the Sun, and afterwards take off the outward Husk of the Berries by means of Hand-Mills, as they do here the Husks of ſeveral ſorts of Grain, to fit them for uſe: And the *Arabians*, in Summer Heats, uſe theſe Husks, Roaſted after the manner of *Coffee Berries*, eſteeming that Drink more Cooling, it being ſourish to the Taſte.

Explication of the Figures

A. A. Repreſents the Shrub, wherein is obſerveable the Manner of its Branching, and of the growing of the Leaves and Fruit.

a a a a. The Fruit, growing 2, 3, or more at a place on the Twigs.

B. One of the Leaves, of its Natural Bigneſs.

C. The Fruit of the true ſize and Figure.

c. The Fruit with the Husk on.

e. The Fruit with the outward Husk taken off.

i. i. The Berry with both Husks taken off.

An Account of Coffee, *By Mr.* J. Houghton, n. 256. p. 311.

XLVI. I cannot learn the uſe of any part of the Coffee-Shrub, except the Berries; of which, boiled in Water, a Drink is made, and drunk much among the *Arabians* and *Turks*. Perhaps 'twas their *Succedaneum* for *Wine*, which *Mahomet* had Prohibited: For by its actual Heat it refreſhes the weary, and does ſeveral other Services, as Wine that Acts by a Potential Heat.

It has not been in uſe (as Mr. *Tavernier* tells us) much above 120 Years. However the uſe of it quickly became General, and that made it a Trade in great Towns. Into the Publick Coffee-Houſes they would come by hundreds, and among them Strangers would venture, where they learned the Cuſtom; and carried it into their own Countries. One Mr. *Raſtall*, an *Engliſh* Merchant, whom I knew, found a Coffee-Houſe at *Leghorn* in 1651. The next Year Mr. *Dan. Edwards*, a Merchant, from *Smyrna* brought into *England* a *Greek* Servant, call'd *Paſqua*, to make his Coffee: ~~So that~~ 'tis likely that this Merchant was the firſt who uſed it in *England*; (tho' I am informed that the famous Dr. *Harvy* did frequently uſe it;) as his Servant *Paſqua*, whom he thought fit to ſet up, was the firſt Coffee-man.

The beſt *Coffee-Berry* is what is large and plump, with a Greeniſh caſt, and having on the thin parts a *Tranſparency*; the other has a *yellowiſh* Caſt, and is more Opaque; but when they are Roaſted, 'tis hard to diſtinguiſh.

I put ſome *Berries* into a Glaſs of Water about a Week ſince, to ſee if they will Sprout, but as yet there is no appearance, altho' they are tolerably ſwell'd, and look White and Bright.

I have made a Decoction of them, which has made them Shoot.

The common way of Preparing the *Berry* for the Drink Coffee, is Roaſting it in a *Tin-Cylindrical Box* full of Holes, through the middle of which runs a *Spit*; under this is a ſemicircular Hearth, wherein is made a large *Charcoal Fire*: By the help of a Jack, the Spit turns ſwift, and ſo it Roaſts, being now and then taken up to be ſhaken. When the Oil ariſes, and its grown of a dark-Brown Colour, it's emptied into two Receivers, made with large Hoops, whoſe bottoms are Iron Plates, theſe ſhut into, and there the Coffee is well ſhaken, and left till almoſt Cold, and if it looks Bright, Oily, and ſhining, 'tis a Sign 'tis well done.

Of this, when freſh, if an Ounce be ground, and boiled in ſomething more than a Quart of Water, till it be fully impregnated with the fine Particles of the *Coffee*, and the reſt is grown ſo ponderous, that it will ſubſide and leave the Liquor clear, and of a reddiſh Colour, it will make about a Quart of very good Coffee.

The beſt way of keeping the *Berries* when *Roaſted*, is in ſome warm Place, where it may not be ſuffered to imbibe any Moiſture, which will pall it, and take off its Briskneſs of Taſte. 'Tis beſt to grind it as uſed ; except it be ramm'd into a *Tin-pot*, well covered and kept dry, and then I believe it will keep good a Month.

There will ſwim upon the *Coffee* an *Oyl*, which the *Turkiſh* great *Coffee-Drinkers* will take in great Plenty, if they can get it. When the Coffee has ſtood ſome time to cool, the groſs Parts will ſubſide, the Briskneſs will be gone, and it will grow flat, and almoſt clear again.

I ſent to the *Chymiſts*, 1 Pound of clean Coffee ; 1 pound of husked *Horſe-Beans*, and 1 Pound of pick'd Wheat ; and I received back,

	Coffee			*Horſe-beans.*				*Wheat.*		
	℥	ʒ	℈	℥	ʒ	℈	gr.	℥	ʒ	℈
Spirit net.	VI.	VI.	o	VI.	I	o	XII	VIII	II.	I.
Oyl	II.	IV.	II.	I	III	o	X	I.	o.	gr. VI.
Cap. Mort.	V.	III.	o.	V.	III	o	o	IV.	VI	

By this Account it appears, that *Coffee* yields by Diſtillation in a Retort, almoſt double as much Oyl as Beans, and almoſt treble as much as *Wheat*.

The Oyls are very thick, but they and the Spirits have all of them ill Savours, as is uſual from burnt Materials.

By Spirit is meant the Phlegm.

The *Capita mortua* have no Smell. They have been calcin'd over and over, with all the Art my *Chymiſt* has ; but he cannot reduce them to a *Calx* or *Aſhes*, and concludes there is no *Salt* to be gotten from them.

From what is ſaid, I note, that from the common Drink call'd *Coffee*, there is little good can come from any part but its Oyl, becauſe its other thin Parts are evaporated, and its thick ſubſides ; but its Oyl, I ſuppoſe to be nutritive *quaſi* an *Oyl*, and warm *quaſi* a *Chymical Oyl*, for all the warm parts are brought hither as to a Point, and thereby it may enliven and invigorate ſome heavy parts in the fermentative Juices, and nouriſh weak Parts within, as other *Chymical Oyls* do the Parts external when rubb'd, but being dilated, as it uſually is, I queſtion whether it does any more good than hot Tea, hot Broth, or any thing elſe that is actually hot ; for I believe that actual and potential Heats are much of the ſame Operation.

It has been generally thought to be an *Anti-hypnotick*, or Hinderer of Sleep, which I dare not gainſay, Dr. *Willis* and other learned Men having declared it ſo, but now it is come into frequent uſe, the contrary is often obſerv'd, although perhaps Cuſtom, as it does with *Opium*, alters its natural Qualities.

I

I am told, that our three Kingdoms ſpend about 100 *Tun* a Year, whereof *England* ſpends about 70 *Tun*; which at 14 *Pounds* a *Tun*. (a middle Price now a-days) will amount to 20586 *l. ſterling*; and if it were to be all ſold in *Coffee-houſes*, it would reach treble, or 61740 Pounds, which at 10 Pounds a Head, will find Employments for 9174 Perſons, although I believe all the People of *England*, one with another, do not ſpend 5 Pounds each.

Coffee, when roaſted, loſes about a 4th part, then there is ſpent about 52 *Tun* and a half of roaſted *Coffee*, which makes 117600 *Pound*, or 15252800 Drams, which, if there be 8 *Millions* of People, is not 2 Drams, or half a *Pint* of *Coffee* a piece for a Year.

Beſides what we uſe, we ſend a great deal abroad, and I doubt not, but in ſhort time, the Gain of what we ſend abroad, will pay the firſt Coſt of all we ſhall ſpend at home; which is one of the beſt ways to make Advantage of Foreign Trade.

The Cacao Tree, by , , n.93 p:6007

XLVII. The Body of a *Cacao-Tree* is commonly about 4 Inches in Diameter, 5 Foot in height, and above 12 from the Ground to the top of the Tree. Theſe Trees are exceedingly different amongſt themſelves; for ſome ſhoot up in 2 or 3 Bodies, others in one. Their Leaves are many of them dead, and moſt diſcolour'd, unleſs on very young Trees. We reckon a Bearing Tree yields from 2 to 8 Pound of *Nuts* a Year; and each *Cod* contains from 20 to 30 *Nuts*.

The manner of curing them is, to cut them down when they are ripe, and to lay them to ſweat 3 or 4 Days in the *Cods*, which is done by laying them on Heaps. After this, they cut the Cods and take out the Nuts, and put them into a *Trough* covered with *Plantan* Leaves, where they ſweat again about 16 or 20 Days. The *Nuts* that are in each Cod are knit together by certain *Fibres*, and have about them a white kind of *Pulp*, that's agreeable to the Palate. By the turning and ſweating, their little Strings are broken, and the *Pulp* is imbibed and mingled with the Subſtance of the Nut. After this, they are put to dry 3 or 4 Weeks in the Sun, and then they become of a reddiſh dark Colour.

The *Cods* grow only out of the Body, or great Limbs and Boughs, and at the ſame Place, there are Bloſſoms, young and ripe Fruit.

The greateſt *Crop* at moſt of our *Cacao Walks* in *Jamaica*, is in *December* or *January*: But at one of Coll. *Modiford*'s Walks, they bear moſt in *May*; yet its not above 5 Miles from thoſe Walks, which bear always in *December*: But thoſe that bear then, have ſome Fruit in *May*, as the other have in *December*.

It's planted firſt in the Nut, always under ſhade. Some do it under *Caſſave*; others, under *Plantane-Trees*, and ſome in the Woods. The *Spaniards* uſe a certain large ſhady Plant, call'd by them *Madre di Cacao*, we, only the others. It muſt alſo be always ſheltred from the *North-Eaſt Winds*. We ſeldom tranſplant, only where it fails, as it doth many times in open, poor, and dry Lands; for this Tree requires to have a flat, moiſt, low Soil,

which

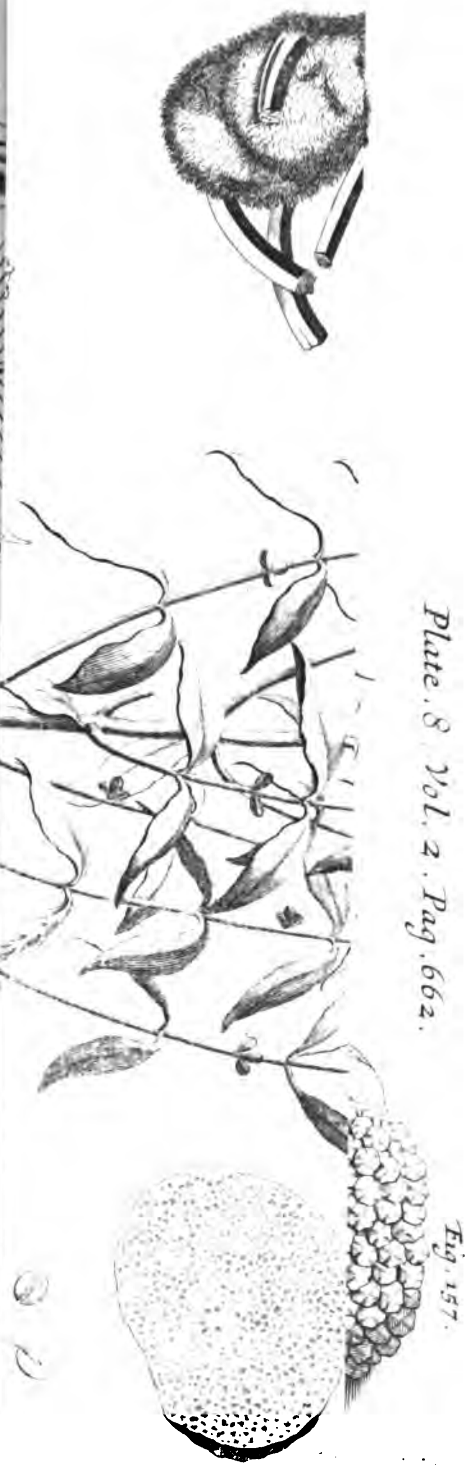

Plate. 8 Vol. 2. Pag. 662.

Fig. 157.

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The Jamaica Pepper tree, by Dr H. *Sloan*, n. 192: p: 462.

Fig. 166

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The Cacao Tree, by , , n.93 p:6: 07
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which makes them to be planted commonly by Rivers, and between Mountains; ſo that it is ill living where there are good *Cacao-Walks.* In a Years time the Plant comes to be 4 Foot high, and hath a Leaf 6 times as big as an old Tree, which, as the Plant grows bigger, falls off, and leſſer comes in their Place.

The Trees are commonly planted at 12 Foot Diſtance, and at 3 Years old, where the Ground is good, and the Plant proſperous, it begins to bear a little; and then they cut down all, or ſome of the Shade; and ſo the Fruit increaſes till the 10*th* or 12*th* Year; then the Tree is ſuppoſed to be in its Prime. How long it may continue ſo, none with us can gueſs, but it's certain, the Root generally ſhoots out *Suckers*, that ſupply the Place of the old Stock when dead, or cut down, unleſs when any ill Quality of the Ground, or Air kill both.

Cacao was originally of theſe *Indies*, and wild; towards *Maracajo*, are divers Spots of it in the Mountains; and I am inform'd the *Portugueze* have lately diſcovered whole Woods of it up the River *Maranon*.

The *Cacao* paſſes by Detail for Money in *New-Spain*, and the Silver Countries.

The Jamaica Pepper tree, by Dr H. *Sloan*, n. 192: p. 462.

Fig. 166

XLVIII. The *Myrtus Arborea Foliis Laurinis aromatica*, Piementa, or *Jamaica Pepper-Tree*, has a Trunk as thick as ones *Thigh*, riſing ſtraight about 30 *Feet* high, covered with an extreamly polite or ſmooth Skin, of a gray Colour, and branched out on every Hand, having the Ends of its Twigs ſet with Leaves of ſeveral Sizes; the largeſt being 4 or 5 *Inches* long, and 2 or 3 broad in the Middle where broadeſt, and when it decreaſes to both Extreams, ending in a Point, ſmooth, thin, ſhining, without any *Inciſures*, of a deep green Colour, and ſtanding on *inch-long foot-ſtalks*, when bruiſed very odoriferous, and in all things like the Leaves of a *Bay-tree*. The ends of the Twigs are branched into Bunches of Flowers, each *Foot-ſtalk* ſuſtaining a *Flower*, made up of 4 herbaceous or pale green *Petala*, bowed back, or reflected downwards, within which are many *Stamina* of the ſame Colour. To theſe follow a Bunch of crowned or *umbilicated Berries* (the Crown being made up of 4 *Foliola* or ſmall Leaves) which are bigger when ripe than *Juniper-Berries*, at firſt when ſmall, greeniſh; but when ripe, they are black, ſmooth and ſhining; containing in a moiſt, green, aromatick and biting *Pulp*, 2 large *Acini*, or Seeds, ſeparated by a Membrane lying between them; each whereof is an *Hemiſphere*, and both joyned make a Globe or Spherical (appearingly one) *Acinus*, whence *Cluſius* makes it one Seed diviſible into 2 Parts.

It grows on all the hilly parts of the *Iſland* of *Jamaica*, but chiefly in the North-ſide thereof: and wherever theſe Trees grow, they are generally left ſtanding when other Trees are fell'd, and they are ſometimes planted where they never grew, becauſe of the great Profit from the cured *Fruit*, ſent in great Quantities yearly into *Europe*.

It flowers in *June*, *July* and *Auguſt*, but in ſeveral Places ſooner or later, according to their ſituation and different ſeaſon for Rains, and after it flowers,

ers, the Fruit ſoon ripens; but 'tis to be obſerv'd, that in clear'd open Grounds, 'tis ſooner ripe than in thick Woods.

There is no great difficulty in the curing, or preſerving of this Fruit for uſe; 'tis for the moſt part done by the *Negroes*, they climb the trees, and pull off the Twigs with the unripe green Fruit, and afterwards carefully ſeparate the Fruit from the Twigs, Leaves and ripe Berries. Which done, they expoſe them to the Sun, from its riſing to ſetting, for many Days, ſpreading them thin on Cloaths, turning them now and then, and carefully avoiding the *Dews*, which are there very great. By this Means they become a little wrinkled, or rugous dry, and from a green change to a brown Colour, and then they are fit for the Market, being of different ſizes, but generally of the bigneſs of *black Pepper*, ſomething like in Smell and Taſte, to *Cloves*, *Juniper-Berries*, *Cinnamon*, and *Pepper*, or rather having a peculiar mixt Smell, ſomewhat a-kin to them all; whence the Name of *All-ſpice*. The ripe Berries are very carefully ſeparated from thoſe to be cured, becauſe their wet and plenteous Pulp renders them unfit for Cure. Whence theſe *Berries* always coming unripe dried into Europe, has been the Occaſion of *Naturaliſts* thinking it to be *Fructu umbilicato Sicco*. The more fragrant and ſmaller they are, they are counted the better.

This Fruit with *Water* diſtill'd *per Veſicam*, yields a very odoriferous Chymical *Oyl*, ſinking to the bottom of *Water* like *Oyl* of *Cloves*. It may deſervedly be counted the beſt and moſt temperate, mild, and innocent of common *Spices*; and fit to come into greater uſe, and to gain more Ground, than yet it hath, of the *Eaſt India* Commodities of this kind; almoſt all of which it far ſurpaſſes, by promoting the Digeſtion of Meat, attenuating Tough Humours, moderately heating, ſtrengthning the Stomach, expelling Wind, doing thoſe friendly offices to the Bowels, as we generally expect from Spices.

It is now commonly ſold by *Druggiſts* for *Carpobalſamum*, which I ſuppoſe came from *Hernandez*, who ſays it may be its *Succedaneum*; But it is not that *Fruit*, but ſeems more fragrant and leſs adſtringent and balſamick. *Cluſius* ſays, that it takes away, if chewed, a *ſtinking Breath*; *John de Barrius* tells us, 'tis one of the ingredients of *Chocolate* in *New Spain*, and *Franciſcus Vria*, who brought it from *New Spain* and gave it to *Redi*, ſaid, it was there commended againſt the *Epilepſie* and *Gutta ſerena*, which he in divers Perſons tried but without ſucceſs: but he at the ſame time ſays, he thinks it a good Stomachick and Cephalick Medicine, moderately given.

Exper. Nat. p: 132. It has been taken by *Cluſius* for *Pliny*'s *Garyophyllon*, and by others for *Amomum*, but it is not likely that it was known to the Ancients, not being known to grow in the *Eaſt*, but *Weſt-Indies*.

It is very likely that *Hernandez* does deſcribe this under the Name of *Kocoxite ſeu Piper Tavaſci*; his Deſcription agreeing in every thing, only the Flower; which no ways agrees to this. And perhaps this is the Tree which *Piſo* deſcribes under the Name of *Anhuiba Miri*.

Cinnamon *and* Millium, by Mr. J. n: 172 p:1031. XLIX. *M. de Villermont* has a ſort of *Cinnamon*, which comes from *Guar-*

daloupe, which is white; and another ſort, which comes from *Maragnan*, which is like that of *Ceilon*.

He has an Ear of the ſmall *Milium* of *Guinea*, about 10 *Inches* long, made juſt like the great Knob of a Cane: the Grains are no bigger than a Pin's-Head, and are very good to eat; the Negroes making their finer Cakes of them.

The wild Cinnamon Tree, by *Dr*. H. *Sloan*, n192. p. 465

L. *Arbor Baccifera, Laurifolia, Aromatica Fructu Viridi Calyculato ramoſo*, or *Wild Cinnamon-Tree*, commonly but falſly call'd *Cortex Winteranus*, has a *Trunk* about the thickneſs of one's Thigh, riſing to about 20 or 30 Foot high, having many Branches and Twigs hanging downwards, making a very comely Top. The *Bark* conſiſts of 2 parts, one *outward*, and another *inward*. The *outward Bark* is thin as a mill'd Shilling, of a whitiſh aſh or grey Colour, with ſome whiter Spot here and there upon it, and ſeveral ſhallow Furrows of a darker Colour, running variouſly through it, making it rough, of an aromatick Taſte. The *inward Bark* is much thicker than *Cinnamon*, being as thick as a mill'd Crown Piece; ſmooth, of a whiter Colour than the *outward*, of a much more biting and aromatick Taſte, ſomething like that of Cloves, and not glutinous like Cinnamon, but dry and crumbling between the Teeth. The *Leaves* come out near the ends of the Twigs, without any order, ſtanding on *inch-long Foot ſtalks*; they are each of them 2 *Inches* long, and one inch broad, near the end where broadeſt and roundiſh, being narrow at the beginning, from whence it augments in breadth to near its end, of a yellowiſh green Colour, ſhining and ſmooth, without any *Inciſures* about its Edges, and ſomewhat reſembling the *Leaves* of *Bay*, or *Lauroceraſus*. The Ends of the Twigs are branched into Bunches of Flowers, ſtanding ſomething like *Umbels*, each of which has a Foot Stalk, on the top of which is a Calix, made up of ſome *Foliola*, in which ſtand 5 ſcarlet or purple *Petala*, within which is a large *Stylus*. To theſe follow ſo many Caliculated Berries, of the Bigneſs of a large Pea, roundiſh, green, and containing within a mucilaginous pale-green thin Pulp, 4 black ſhining Seeds, or *Acini*, of an irregular Figure.

All the parts of this Tree when freſh are very hot, aromatick and biting to the Taſte, ſomething like Cloves, which is ſo troubleſome, as ſometimes to need a Remedy from fair Water.

It grows in the Low-Land, or *Savanna Woods*, very frequently on each ſide of the Road between *Paſſage Fort* and the Town of St. *Jago de la Vega* in *Jamaica*, in *Antigoa*, and other the Caribbee Iſlands.

The Bark of this Tree is what is chiefly in uſe, both in the Plantations of the *Engliſh* between the Tropicks in the *Weſt Indies*, and in *Europe*; and is without any Difficulty cured, by only cutting off the Bark, and letting it dry in the Shade.

It is in uſe in the *Weſt-Indies* by the more ordinary ſort of People, in place of all other Spices, being thought very good to conſume the immoderate humidities of the Stomach, help Digeſtion, expel Wind, &c.

It is likewiſe, as well there as in *Europe*, thought a very good Remedy againſt the *Scurvy*, and to cleanſe and envigorate the Blood, being in *London* Druggiſts and Apothecaries Shops uſed for thoſe purpoſes, under the name of *Cortex Winteranus*, which it is not, but may very well ſupply its Place. It is in the *Weſt-Indies* mixed and given with *Steel*, and other Medicines, but if the Patient be any way of a hot Conſtitution, it does more Harm than Good, being very warm.

Rum, a *Vinous Spirit* drawn from *Moloſſus*, or bad *Sugar* fermented with Water, if it be mixed with ſome of this Bark, it loſes in part its loathſome Empyreumatick Smell.

This *Bark*, if mixed with Water, and *diſtill'd per Veſicam*, yields an *Aromatick Oil*, ſinking to the bottom of Water like *Oil* of *Cloves*, with ſome ſmall Quantity of which it being mixed, has ſometimes been ſold for true *Oil* of *Cloves*. *Peter Martyr* mentions it under the Name of *Cortex Cinnamomi Saporem*, *Gingiberis Amaritudinem*, & *Cariophylli ſuavem Odorem præ ſe ferens*. *Nic. Monardes* deſcribes it under the Name of *Lignum Aromaticum*; *Cluſius* calls it *Lignum*, *ſeu potius Cortex Aromaticus*; and I queſtion not but this is the ſame with the *White-cinnamon*, or the *Canella Alba*, in ſome other Authors. *Linſchoten* in his Deſcription of *America*, tranſlated into *French*, gives an Account of it under the Name of *Arbre, ou les Pigeons nichent*; Dr. *Trapham* calls it *Winter-Bark*, or *Weſt-Indian Cinnamon-tree*; *Hernandez* and *Ximenes*, *Caninga*.

But it may be doubted whether this be the *Aſoopo* of *Hariot*.

The true Cortex winteranus, by Dr. H. Sloan, n. 204. p. 922.

LI. Capt. *Winter*, who went out with Sr. *Fr. Drake*, when he went round the World, at his Return brought with him from the *Streights* of *Magellan*, an *aromatick Bark*, which had been very helpful to thoſe of his Ship, both uſed inſtead of other Spices with their Meat, and as a Medicine very powerful againſt the *Scurvy*. *Cluſius* from this Captain's Name, calls it *cortex Winteranus*, and the Tree *Magellanica Aromatica Arbor*. The Writer of the Journal of the *Dutch* Ships that went to the Streights of *Magellan* about 1599, calls it *Lauro ſimilis Arbor*, *licet procerior*, *cortice Piperis modo Acri & mordenti*. And *Sebald de Weert*, who was there, ſays, that both Leaves and Bark were uſed with their Meat and Muskles, to correct them in ſo cold a Climate. *Caſpar Bauhine* calls it *Laurifolia magellanica cortice Acri*; *Johnſton*, *Arbor Laurifolia magellanica*.

Fig. 168. But Mr. *Geo. Handyſide*, who came from thence about 2 or 3 Years ſince,
gives the beſt account of it; having brought with him a *ſpecimen*, or Sample
Fig. 169. of its Leaves and Flowers on the Twig and its Seed; by which I cannot reduce it to any of our kind of Plants ſo well as the *Pereclymenum*: and therefore I ſhall call it, tho' it differs in many things from the *Honyſuckle*, *Periclymenum rectum Foliis Laurinis cortice Acri aromatico*.

He aſſured me that this Tree roſe to be higher and larger than an *Apple-Tree*, ſpreading very much both in Root and Branches: The Twigs had on them Leaves of a light Green Colour on their upper ſide, ſtanding on *half-inch long Foot-ſtalks*; are an Inch and half long, and an Inch broad in the Middle, where broadeſt, and whence they decreaſe to both ends, ending blunt. The *Flowers* come, *ex alis Foliorum*, ſtanding on $\frac{3}{4}$ inch long Stalks; 2, 3 or more of them together, ſomething like thoſe of the *Pereclymenum*, each of them are milk white, *Pentapetalous*, and ſmell like Jeſſamine; to which ſucceeds an oval Berry, made up of 2 or 3, or more *Acins*, or little *Berries*, ſtanding together on the ſame common *Foot-ſtalk*, of a light green Colour, with ſome black Spots, and in theſe Berries are contained ſeveral black aromatick ſeeds, ſomething like the Stones in Grapes.

It grows in the middle of the *Streights* of *Magellan* very plentifully.

The *Leaves* of this Tree were uſed with other Herbs, by Mr. *Handyſide*, for *Fomentations* in ſeveral Caſes, with very good Succeſs, but he admired moſt the Uſe of the *Bark* inwardly, boyling half a Dram of it with ſome *Carminative Seeds*, and giving it ſo to thoſe of the Ship who were under his Care very much afflicted with the *Scurvy*. It uſually ſweated them, and they were very much Relieved. The ſame Medicine likewiſe he adminiſtred to a great many of the Ship, who were very ill by Eating a poyſonous ſort of *Seol* in thoſe parts, call'd a *Sea-Lyon*, with which they had a a very great Amendment, altho' they had been ſo ill with feeding on this Creature, as to loſe moſt of their Skins, which peel'd off their Bodies by degrees, and in large Pieces; ſo that the Antidote to this ſtrange Poyſon was to be had very near it, and was very much extoll'd by this Gentleman, who was put to a Stand to know what to do in this ſtrange Caſe, although he very well underſtood the *Materia medica*.

By Deſcription of this Tree and that of *Wild-cinnamon*, it appears, that the *Cortex Winteranus* commonly ſold in Shops, is not the true *Cortex Winteranus*. But I muſt needs ſay, tho' they are the Barks of two very differing Trees, and growing in very differing places, and appear quite another thing in their outward Faces: Yet their *Taſte* is much the ſame, and I believe they may be uſed as a *Succedaneum*, one for another; though the true be much to be valued beyond the falſe, being much more aromatick.

An Account of the Propagation of Elms ſeed, by *Sir* Rich. Bulkley, n. 205. p. 971.

LII. I have diſcourſed a poor meer *Iriſh* Labourer, (who, by having worked many Years under a Head Gardiner, in a Gentleman's Garden, has got a Genius of Planting) who has follow'd the Propagation of Elms, by the Seed; (a Way if known, totally neglected among all Planters) which Seed he finds in the former part of the Year: and he has raiſed in ſmall Beds ſuch vaſt Numbers of them, that he ſells them of 3 or 4 foot long, at 2. *s.* a Hundred, and will carry them any where within 5 Miles, and plant them in to the Bargain.

A ſort of Sugar from Maple, by ,, n.171.p.998

LIII. The *Savages* of *Canada*, in the time that the Sap riſes in the *Maple*, make an inciſion in the *Tree*, by which it runs out, and after they have evaporated 8 Pounds of the Liquor, there remains 1 pound, as ſweet, and as much *Sugar*, as that which is got out of the Canes; part of the ſame Sugar is ſent to be refined at *Roven*.

The *Savages* have practiſed this Art longer than any now living among them, can remember.

There is made with this Sugar a very good Syrup of *Maiden-hair*, and other capillary Plants, which is uſed in *France*.

Oak prepared for Tanning, by Mr. Ch. Howard *of* Norfolk, *n.* 105. p. 93.

LIV. Every part of the *Oak Tree*, of what Age or Growth ſoever, and all *oaken coppice Wood* of any Age or Size, being cut and procured in *Barking time*, will tan all ſorts of Leather, as well at leaſt as *Bark* alone.

This Material being gotten in its proper Seaſon, it muſt be very well dryed in the Sun, and more than Bark, then houſed dry, and kept dry for uſe, and when it is to be uſed, the greater Wood may be ſhaved ſmall, or cleft, and the ſmall bruiſed with a *Hammer*, and cut ſmall; which done, it muſt again be dried very well upon a Kiln, and then ground as Tanners uſually do their Bark.

Such Wood as it is to be uſed preſently after 'tis gotten, will require the better and more drying upon the Kiln; otherwiſe, it will blacken and ſpoil all the Leather.

Inſtead of an Anvil, to beat and bruiſe the tanning Stuff upon, fit into a wooden Block a Plate of Iron about 4 inches deep, 9 inches broad, and 12 inches long. The Hammer for bruiſing the Stuff may be of 6 *l.* weight, and have the Head about 3 inches ſquare, to work with both Hands; but to work with one Hand, or for a Youth to uſe, let it be of about 3 *l.* weight, and the Head about 2 inches ſquare. The ſurface of one End of theſe Hammers is beſt to be ſmooth, but that of the other dented; the better to enter into the Stuff for quicker Diſpatch. They are to be well ſteel'd at both ends, the Handles of theſe Hammers may be about a Foot long; the bigger ought to be ſomewhat longer.

The Knife to cut the bruiſed Stuff, may be 8 or 9 inches broad, and near as much in Depth, made like a *Tobacco Knife*, with a Handle to work.

Where Oak is ſcarce, Thorns may indifferently well ſupply that Scarcity.

Birch ordered and uſed inſtead of *Oak*, is very fit for *Soal Leather*.

As theſe ingredients will tan better than *Bark* alone, and that with far leſs Charge, ſo may this invention ſave the Felling of *Timber*, when the Sap is up; which when 'tis done, cauſes the Outſide of the Trees to rot and grow worm-eaten; whereas, if the Trees had been fell'd in *Winter*, when the Sap was down, they would have been almoſt all Heart, (as they call it) and not ſo ſubject to Worms. Beſides that, this invention will greatly improve the Value of Underwoods.

LV. There is no ſuch *Dwarf-Oak* in *England*, growing wild, as was ſent you out of *New England*; nor in any other Country where we have been; unleſs it be the *Ilex Cocciſera*, which is a Low Shrub, bearing large *Acorns*, and hath a *Prickly Leaf* like *Holly*. If it prove that, it will be a Luciferous Diſcovery.

A Dwarf Oak *from* New England, By Mr. Fr Willoughby. n. 58. p. 1200.

LVI. Five Leagues from *Marſeiles* are very high Mountains, which are (for the moſt part) covered with Foreſts of *Pine Trees*, which there grow Wild; half a League out of the Road, you ſee the making of *Pitch*, *Tar*, *Roſin* and *Turpentine*, which is thus, *viz.* in the Spring time when the Sap runs moſt, they pare off the Bark of the *Pine* to make the Sap run down into an Hole, which they cut at the bottom to receive it; as it runs, it leaves a Cream or Cruſt behind it, which they take and temper in Water, and ſell, by a Cheat, for White *Bees-Wax*, that they make *Flambeaus* of, and is a great deal dearer. Then they take up the Juice in Spoons from the bottom, and after they have ſo gotten a good quantity, they ſtrain it through a *Grocer's* Basket, ſuch as they put their *Malaga Raiſins* in; that which runs through eaſily is the common *Turpentine*. Then they take that which remains above, and adding a ſufficient Quantity of Water, diſtil it in an *Alemibck*; that which is ſo diſtilled is Oyl of *Turpentine*, and the *Calx* that remains is common *Roſin*. Then they cut the Stock of the Tree into large *Chips*, and pile them hollow in a Cave; covering it on the top with Tiles, but ſo as to let ſome Air come in to feed the Fire; then burning them, there runs a thick Juyce down to the bottom, where they make a ſmall Hole for it to run out at, (a larger Hole would ſet it all in a Flame,) and that which ſo runs out is *Tar*. Then they take off that, and boiling it gently over again, to conſume more of the Moiſture, they ſet it to Cool; which when Cool is *Pitch*.

The Way of making Pitch, Tarr, Roſin *and* Turpentine, By Mr. Tho Bent. n. 243. p. 291

LVII. In *Jamaica*, the Neighbouring Iſles, and Continent of *America*, grow many ſorts of *Miſſeltoe*; *Paraſitical Plants*, as they are called by ſome, or *Epidendra* by others; which grow on the Bodies or Arms of Trees, after the manner of *Miſſeltoe*, like to which they bring forth Roots, Leaves, Stalks, Flowers and Seed. From this likeneſs I have given the Name *Viſcum*, to all the ſeveral Families of them; tho' they differ very much from it, and almoſt as much amongſt themſelves.

A ſort of Miſſeltoe *in* Jamaica; By Dr. H. Sloan. n. 251 p. 113

There is one Family among them which I call *Viſcum Cariophyloides*, from having its Seed *Veſſel* ſomewhat like that of *Clove-July Flowers*, and a particular one of that Family which I Name *Viſcum Cariophyloides Maximum, Flore Tripetalo pallide Luteo Semine Filamentoſo*, and which is commonly in that Iſland called, *Wild Pine*; whoſe Deſcription follows. A great many *Brown-Fibrils* encompaſs the Arms, or take firm hold of the Bark of the Trunk of the Trees whereon they Grow: Not as *Miſſeltoe*, entring the Bark or Wood, to ſuck Nouriſhment, but only weaving and matting themſelves among one another, and thereby making to the Plant a firm and ſtrong Foundation. From hence riſe ſeveral Leaves on every ſide, as *a a a a*, after the manner of *Leeks*, *Ananas*, whence the name of *Wild-Pine*,

Catal, Jam Plan

Fig. 170

Pine, or *Aloes*, being folded or incloſed one within another; each of which is two Foot and a half long; from a 3 Inch breadth at beginning, or Baſe, ending in a Point; having very Hollow or Concave inward-ſides, is made within a very large *Reſervatory*, *Ciſtern*, or *Baſin*, *b.* fit to contain a pretty deal of Water; which in the Rainy Seaſons falls upon the uppermoſt parts of the ſpreading Leaves, which have Channels in them, conveying it down to the Ciſtern, where it is kept, as in a Bottle; the Leaves, after they are ſwelled out like a *Bulbous Root* to make the Bottle, bending inwards, or coming again cloſe to the Stalk, by that means hindering the Evaporation of the Water by the heat of the Sun. They are of a Light Green Colour below, and like Leeks above. From the midſt of theſe riſes a round, ſmooth, ſtrait, freſh Green coloured Stalk, 3 or 4 Foot long, *c.* having many Branches; when wounded, yielding a clear *Mucilaginous Gum.* The Flowers come out here and there on the Branches; they are made up of 3 long yellowiſh, white, or Herbaceous *Petala*, and ſome Purple-ended *Stamina*, ſtanding in a long *Calix*, or *Tubulus*, made up of 3 Green viſcid Leaves, with Purple Edges, to which follows a long triangular *Capſula*, *d.* Greeniſh Brown, being ſomewhat like thoſe of the *Cariophylli*; having under it three ſhort *Capſular Leaves*, and within ſeveral long *Pappous Seeds*, the Seed it ſelf being Oblong, Pyramidal, and very ſmall, having very ſoft Hairs, Down or *Tomentum*; much longer in Proportion to the Seed, than any *Tomentum* I know; being as long as the *Pod* or *Capſula.*

It grows on the Arms of Trees, every where in the Woods, as alſo on the Barks of their Trunks; eſpecially when they begin to decay, their Barks receiving the Seed, and yielding then more eaſily to the *Fibrils* of this Plant's Roots, which in ſome time diſſolves them, and Ruins the whole Trunk.

The *Contrivance* of Nature in this Vegetable is very Admirable; the Seed has long and many Threads of *Tomentum*; not only that it may be Carried every where by the Wind, as the *Pappous* and *Tomentoſe Seeds* of *Hieracium*, *Lyſimachia*, *&c.* are, but alſo, that it may by thoſe Threads, when driven through the Boughs, be held faſt, and ſo ſtick to the Arms and extant parts of the Barks of Trees. So ſoon as it Sprouts or Germinates, altho' it be on the under parts of a Bough, or the Trunk of the Tree, its Leaves and Stalk riſe Perpendicular, or ſtrait up: Becauſe if it had any other Poſition, the Ciſtern before mentioned (by which it is chiefly nouriſhed; not having any Commnnication with the Tree,) made of the Hollow Leaves, could not hold Water which is neceſſary for the Nouriſhment and Life of the Plant.

In the Mountainous as well as dry low Woods, in ſcarcity of Water, this *Reſervatory* is neceſſary, and ſufficient, not only for the Plant it ſelf, but likewiſe is very uſeful to Men, Birds, and all ſorts of Inſects; whither in ſcarcity of Water, they come in Troops, and ſeldom go away without Refreſhment.

There are ſome Contrivances in Plants growing in *Europe*, which come near thoſe of this kind of Vegetables, in ſome Particulars. The *Virga Paſto-*

ris, or *Wild Teaſel*, (and moſt Plants call'd *Perfoliated*) has its Leaves incloſing its Stalk, and ſo ſet by Pairs oppoſite to one another, and joined by their Baſes, that they may make a hollow place, fit to contain ſome Water, which, tho' open, yet without doubt, contributes to the perfecting of the Plant.

Several *Fuci* are lately diſcovered to have Seeds, which, when Ripe, break out of their Places, and by means of a Glewy Juice faſten themſelves to the Stones, or other Subſtances at the bottom of the Sea, where they are to grow. The common *Viſcum* had ſuch a Glewy Subſtance, I ſuppoſe, for faſtning its Seed to the Barks of Trees.

Small *Moſſes*, heretofore thought to have no Seed, are now known to have great plenty; And that ſo ſmall, as I have ſeen it riſe up from the Ripe-Head, in form of Smoak; which is without Queſtion that it may be carried by the Air and Wind, to Walls, Trees, or other fit *Matrix* for its *Vegetation*.

There is a *Fungus*, call'd by *Cluſius*, *Fungus Minimus Anonymus*; and by Dr. *Merret*, *Campaniformis Niger multa ſemina plana in ſe continens*, (which I have ſhewn the *R. Society* many Years ſince) that when Ripe opens in the Rain, by which one filling a Cup, wherein lies its Seeds, they are waſhed out on every hand, to Propagate its kind.

There are many Families of Plants with *Pappous*, or *Tomentoſe*, *Seeds*; as *Dandelion*'s, *Erigerum*'s, *Lyſimachia*'s, *Clematis*'s, *Anemone*'s, *&c.* which being Ripe, their Seeds are by means of their Feathers, or Wings, ſcattered *Hort. Bleſ.* p. 10.
to all Neighbouring Parts by the Wind. This is ſo effectual a way that the *Aſter Canadenſis annuus non deſcriptus*, *Brunyer*, or *Conyza*, *annua Alba Acris*, *Moriſ.* (which came at firſt from *Canada*) is now become a Wild-Plant in many Places of *Europe*, where it never was obſerved to grow and far from the Gardens where it was firſt Planted; from whence the Seed had been carried by its Wings; ſo that I have ſeen it in ſome parts of *France*, very many Leagues from ſuch Places.

There are likewiſe many Plants, which have Seed Veſſels ſo contrived as with a Spring, and ſometimes, ſmart Noiſe, when they are Ripe, to throw off their Seeds ſeveral ways, to a conſiderale diſtance. Moſt Plants having *Pods*, as *Furze*, *&c.* thoſe called *Noli me Tangere*, or *Herbæ Impatientes*, *Cucumis aſininus*, *Cranes-bills*, and many others, have this Artifice to ſow themſelves. Amongſt thoſe who have this Property, none is more ſurpriſing than one in *Jamaica*, called *Spirit-Weed*, which when its Seed is Ripe, the Veſſel containing it, on the leaſt touch of whatever is Wet, does inſtantly open its ſelf, and with a ſmart noiſe, throws its Seed ſeveral ways to a conſiderable diſtance; likely the deſign of Nature being, that the Rainy Seaſon being proper for ſowing, its Seed ſhould be kept in its *Seed-Veſſel*, the beſt Preſerver of it from Injuries till then.

Lychnis's, *Poppies*, *Antirrhinum*'s, and many others, have their Seeds in Heads, which when Ripe, are open at top, and by the Winds, and help of their *Partitions*, are ſcattered and directed to all Quarters.

Theſe Inſtances, and many more, very Obvious and Wonderful, tho' not taken notice of, might be given to ſhew the great Endeavours of Nature to Perfect the *Individuum*, and *Propagate* the kind; which for that Reaſon, I am apt to believe, are all (without the loſs of one *Species)* preſerved to us, from the Creation to this Day.

The Silver-Pine *from the* Cape *of* Good Hope; By *Dr* H. *S*loan. n.198.p.664

LVIII. A Branch of the Silver-Pine, or *Conifera ſalicis Facie, Folio & Fructu, Tomento ſericeo candicante obductis ſemine Pennato*, was lately brought into *England* from the *Cape* of *Good Hope*, by Mr. *Goddard*. The twig of this Tree had a great many Leaves ſet round it very cloſe to one another, ſo as to hide the Twig it ſelf there where they grow; each of the largeſt of them being about 4 Inches long, and ¾ of an Inch broad, in the middle where broadeſt, from whence they decreaſe towards both Extreams, ending in a Point; being like thoſe of the *Oſier Willow*, only broader, and all covered over with the thickeſt, fineſt and longeſt White Silken Hair or Down, that ever any Plant I remember to have ſeen has. The Cones are of the bigneſs of thoſe of the *Cedars* of *Lebanon*, and of the ſame ſhape; the *Cuticula*, or ſmall Skin of each *Scale*, being covered over with a white ſhort Down or Wool, ſhining alſo like Silk; between the *Scales* is lodged the *Seed* C. which is almoſt as large as the *Pine-Nut*, near the ſame ſhape, of a dark brown Colour, and having a riſing Eminent Line or Belly running through Membrane D. which has on its top 4 Feathers, like thoſe belonging to the *Seeds* of *Clematis*; which being between the *Scales*, and riſing above them, adds a very great Beauty to the Cone; and may likewiſe ſerve for Wings, by means of the Wind to looſen or carry the *Seeds* to diſtant places, thereby Propagating its ſelf.

Fig. 171

Fig. 172

Dr. *Plucknet* has figur'd it under the Name of *Leucadendros Africana Arbor tota Argentea, Sericea Foliis integris*; *Atlas-Tree, D. Herman.*

Another Coniferous *Tree, from the* Cape *of* Good Hope; By *Dr.* H. Sloan n.198.p.666

LIX. *Conifera, Alypi folio, Seminibus pennatis pluribus in medio Coni conglomeratis, & non inter Squammas, aliorum Conorum more, naſcentibus.*

A Branch of this Tree with its Fruit was lately brought from the *Cape* of *Good Hope*, by Mr. *Goddard*. It had a brown colour'd ſmooth Bark, with a whitiſh hard Wool, and ſmall Pith. The Leaves (expreſſed to their Natural Bigneſs *F.)* were round it without any Order, very thick ſet, having no Foot-Stalks, being about 2 Inches and ½ long, and about ⅓ of an Inch broad, near the farther end where broadeſt, ſmooth, hard, and of a browniſh or dirty green Colour. On the top of the Branch comes the Fruit, *G* which is ſurrounded by 3 or 4 Twigs, *H. I. K.* Overtopping it, and with their Leaves almoſt hiding it. It is about 5 Inches long, and is made up of many Scales, hard and red, encloſing one another: The lowermoſt and outwardmoſt being very ſhort, the inwardmoſt 4 Inches long each of them ending in a Point; ſome Scales having on their outſides a Gummy Juice. In the middle of theſe Scales were the firſt Rudiments of many Seeds as *L.* the ſame not being fully Ripe; each of which is ſet about with a great Quantity of ¾ Inch long, yellow, fine, ſilken Down, *M.* having 2 Inches long *Stylus*,

Fig. 173

or String *N.* and yellowiſh Membranes *O*, encloſing the *Stylus* and *Tomentum*, being feathered at top with Feathers, like the *Silver Pine*, and for the ſame purpoſes.

Obſervations and Experiments concerning Vegetation, and the running of Sap, by Dr J Beal, and *Dr.* Ez. Tonge, n. 43. p. 853.

LX. 1. There are ſeveral ſorts of *Vegetables* that will grow the wrong End ſet downwards in the Ground, as *Elders*, *Bryars*, *Sallies*, *Willows*, the *black Elder*, *Vines*, and moſt Shrubs: two or three of their Joynts, being covered in the Mould and the Stem cut off near the overmoſt Joint, which ſhould be half-covered in the Mould, and the Mould ſomewhat raiſed, as it ſpirts out and grows. Dr. *B. Curran trees*, and ſuch like as are of a ſoft Wood, and Quick Growers, ſeem moſt apt to this improvement. Dr. *T.*

2. The Branch of a *Plant* being laid in the Ground, whilſt yet growing on a Tree, and there taking Root, being cut off whilſt ſo growing, will grow on both ends, if it be well rooted in the Propagation; and the like Care had of the laſt Knot or Joint, as was before preſcribed. Dr. *B.* the Layers of thoſe trees and ſhrubs mentioned in the former Obſervation, will grow on both Ends, and aptly parted when they have ſpread Roots both ways, make two Plants out of each Layer. Dr. *T.*

3. In the *tapping of trees*, the Juice certainly aſcends from the *Root*, and after it is concocted to partake of the nature of the *Plant*, which feeds as well on the *Air* as the Juice furniſh'd thro' the Root, it deſcends (as the Liquor in a *Limbeck*) to the *Orifice* whence it iſſues. *Ratray* the learned *Scot*, affirms, that he hath calculated experimentally, that the Liquor which may be drawn from the *Birch* in the Spring-time, is equiponderant to the whole weight of the *Tree*, *Branches*, *Roots*, and all together. And perhaps this kind of large natural *Limbeck*, where it may be had, may ſometimes prove more effectual than our little artificial and more troubleſome Diſtillations. And the Congeniality of the Sun in its alternative Viſits, and the aſſiduous intercourſe of the free Air with the *Spirit* of the *Plant*, yet living and growing, may have a more effectual influence for a ſpecifick Virtue than we are apt to imagine. Though we cannot ſee nor hear the Lungs of vegetable Beating, yet me may ſometimes ſmell their Breath ſtrong enough both to pleaſe and offend exceedingly; as in *Savin*, *Firrs*, *Cypreſs*, *Elder*, *Roſemary*, *Myrtles*, and generally in all Bloſſomers. And ſome that cannot be ſmelt by us, may yet have a very wholſome Breath. One Experiment I will here beſtow on you. When both my Hands were manacled for many Years (and ſometimes my Arms alſo) with deep corroding *Tetters*, to the Bluſh of my many friendly Phyſicians, and in deſpite of many of the beſt Medicines and Purgations, all was ſuddenly healed, and hath ſo continued theſe 20 Years, by the Application of the Gum of *Plum-trees* diſſolved in *Vinegar*. I muſt not forget to add, that I applied *Vine leaves*, and ſometimes opened Raiſins to draw a Moiſture from theſe tetters, ſome few Days before I uſed the Gum. Dr. *B.*

Dr. *Tonge* is of Opinion, that *Sap* always riſes, and never properly deſcends, having only a kind of ſubſiding or Recidivation, which he ſaith he cannot call a Circulation, nor reſemble to the Motion of Liquors in a *Pellican*, but rather to the ſinking of *Liquors* in an *Alembick*, whilſt the thinner parts are forced over the Helm; yet ſomewhat imitating the Motion of

Blood in *Animals*, for as much as it continually ſupplies the want and expence of Sap in the exterior parts, from the Stock of the Sap in the Trunk, Root, and Branches.

He underſtands it thus, that the *Sap* neceſſary to the growth of the *Leaves*, *Fruit* and *upper Branches*, being diſpenſed and converted into the Form neceſſary for theſe purpoſes, when the *Tree* is fulleſt of *Sap*, in ſuch manner that the *Sap* in the innermoſt Coats feeds the innermoſt, and the Sap of the outward Coats, the outward Parts, of Fruits, *&c.* that which remains in the *Body* betwixt the ſeveral Coats, and betwixt the Bark and Body, begins to condenſe there alſo, firſt into a *Gelly*, and after into *Wood*, *Bark*, *Roots*, *&c.* according to the ſeveral Places to which it hath ſubſided. And becauſe it condenſeth faſter in ſome parts than in others, according as they be higher or lower, whether it be by Heat or Cold, or Exhalation of thinner parts, the *Sap* condenſed above or below, filling leſs Room, muſt needs cauſe the *Sap*, which is not yet condenſed in appearance to deſcend or ſubſide, and to ſink as it were lower and lower, in the *Pores* of the *Timber* and *Bark*, *i. e.* to be leſs high, not deſcend from any place to which it was formerly riſen, unleſs (as in *Blood-letting*, when ſome lower part is opened, all the Sap above continually flows thither, till the *Tree* be emptied, or the continual Flux of the *Sap* (the *natural Balſam of the Tree*) heal the *Wounds*, as that of the Blood does thoſe of the *Body*; and ſo much quicker and eaſier, by how much the Air is more favourable, or is better kept out, which he obſerves for their Direction, who are curious in *Inoculation*, as the Ground of their Succeſſes or Miſcarriages. The *Trees* obſerved by the ſame Dr. *T.* to run, are the *Vine*; the *Birch*, plentifully at *Body*, *Branches* and *Roots*, the *Walnut-tree*, at the *Roots* and pruned *Branches*; ſome *Willows* and *Sallies*; and ſome ſorts of *Maple*; the *Sycamore*, which is the greater *Maple*, (ſome call it the *Plane*) at a *Gaſh* made on the *Bark* of his *Body*, and at the *Roots* and *Branches*; the *Poplar* and *Aſp*. Some *Woodmen* affirm, that in ſuch *Oaks* as are *windſhaken*, that have large *Hollowneſſes* in their *Arms* and *Bodies*, they have found great quantities of Sap in the cutting of them, whereof having drunk, they quenched their thirſt without any prejudice. To theſe add the *Whitting* or *Quicking-tree* (*Lat. Fraxinus Sylveſtris*, and by ſome, *Fraxinus Cambro Britannica*) which in its ſeaſon, as ſome affirm, will run plenteouſly, and whence they would have us expect a ſoveraign Drink againſt ſome ſtubborn Diſtempers, eſpecially ſuch as are *Scorbutical* and *Spleneticke*. I have kept (ſaith Dr. *T.*) ſome of the Juice of the *Berries* (which being expreſſed Ferments of it ſelf) theſe 2 *Years* in Bottles, and it hath now the taſt of an auſtere *Cyder*, and I ſuppoſe from its grateful ſmell, that it may be kept till it ripen, and become a ſtrong vinous Liquor. It is the houſhould Drink of ſome Families in theſe parts, about *Wales* and *Herefordſhire*, and ſome out of Curioſity have brewed ripe Berries, with ſtrong Beer and Ale, and kept it till it tranſcended all the other Beer in Goodneſs.

Dr. *Tonge*'s attempts upon the *Poplar*, *Aſp*, *Elm*, *Oak*, *Aſh*, *Elder*, *Whitting-Berry* or *Quicking-tree*, *Thorn*, *Buckthorn*, *Tile*, *Nut*, *Sloe*, *Briar*, *Bramble*, *&c.* have not ſucceeded, and he doubts, that they, and all *Apples* and *Pears* have ſome degree of Gummineſs in their Juices, ſo that they will not run.

4. The Sap apparently riſeth by the *inward Bark*, where you may ſee the *Quick* begin, and where the Graft firſt incorporateth. Dr. *B.*

Dr. *T.* obſerves that there are Circles in Trees, which are the Diſtances of thoſe *Films* or *Coats*, by which the tree receives its yearly increaſe in thickneſs. Thro' theſe, looking full of circular *Pores*, the Sap ſeems to aſcend in the ſame manner between *Coat* and *Coat*, as between the *Bark* and the *Body*. Now the Aſcent of Sap is by all Parts and Pores of the tree in ſuch ſmall Quantities, as can hardly be diſcerned, unleſs the Tree be quite ſawed off; eſpecially near the *Root*; for then it will appear how it aſcends. In *Birches*, and ſuch like, the Sap iſſues very plentifully in all parts of the Body, when they are cut down near the Root.

The *Bark* is double, outward and inward; the outward is dry, and in ſome trees rough; the inner is probably a ſuperadded new Coat of that Years Growth, or ſomething like it, between the Nature of Wood and Bark. The Sap riſes within and without that ſuperadded Coat.

To perfect the Experiment about *Sap*, and to find whether it aſcends more or leſs in the *prickt Circles* of the *Body*, than in thoſe betwixt the *Body* and the *Bark*; let the tree, exempted from all its *Sap* the Day before, be firſt pierced with an *Augre*, only thro' the Bark, and the quantity of Sap it yields in an Hour exactly meaſured and weighed; then at the ſame time, let another *Hole* be bored into the body of the tree, above an Inch and an half deep, and ſo round about on every ſide of the tree, ſome deeper and ſome ſhallower, with a good large *Augre*, and one quite thro' ſloaping. From which Experiment, after various trials, may be found the difference of the *Sap*, riſing on the *North* and *South*; and ſo likewiſe of that which comes from the *Bark* only peel'd off, and that which aſcends in the inner part of the tree. The Weight may be alſo compared of that which iſſues from the Bark, with that which iſſues from the Body. The internal Heart Sap may alſo be drawn apart, by boring a ſmaller *Augre-hole* in the middle of a greater, and fitting it with a long Pipe adjuſted to that inner Orifice.

n. 46. p. 913

5. Dr *Beal* ſaith, experimentally, that if a Circle be drawn round about any common *Engliſh Tree*, as *Oak*, *Elm*, *Poplar*, &c. by Inciſion, to the *Timber* (how thin ſoever the Knife be) ſo that no part of the *Rind* or *Bark*, to the very ſolid timber be uncut, the tree will die from that part upwards. Only the *Aſh*, (of all that I could try) will grow on and proſper, notwithſtanding the *Inciſion*. My Brother (*T. B*) ſhew'd me ſome old and huge *Aſhes*, which were bared of the Bark by the *Deer*, from the Root, 4 Feet upwards, quite round, yet they had continued their Growth many Years, and ſome parts of the *Bark* which were left in few Places not ſo broad as the *Palm* of my Hand, had a freſh *Verdure*, more lively than the Parts of the Bark which remained above the *Baring*. Yet if ſome *Inciſions* by *Hackings* be made, or if the *Branches* of ſome Fruit-trees (eſpecially the *Gennet Moyle*,) be quite bared under a Knot near the Body of the Tree, and that Knot and bare Part be well cover'd with *Loame*, or good Mould in *June*, that Branch will not only ſurvive, but will be apt to take Root and become a Young

Tree of ſpeedy Growth, if cut off below the *Baring*, and ſet at a fit Depth at the End of *Autumn*; or about *Candlemas* rather. Where ſuch tranſverſe Hackings are made, or Contuſions in the Bark, many *Vegetables* are apt to gather Knobs, and ſometimes ſmall Branches will ſpirt out above, and ſometimes about the Part contuſed. To get the *Gum* of the Plum-trees, I have ſometimes wrenched the Branch, till the ſolid Timber hath Crackt, and the *Rind* forced open in ſome Parts, ſo leaving it to grow, but forced to continue in a Poſture ſomewhat wreathed, it hath not failed to yield me ſtore of *Gum* next Summer.

Vide infra, n. ix. Dr. *T.* A Branch, whoſe Bark of the breadth of about 2 or 3 Inches, is taken off round towards the bottom, in ſome Trees, and particularly the *Lime-tree*, will live and bear Leaves for many Years, and grow as other branches, by Means of the Sap aſcending thro' all the Pores of the inner Coats, as was ſaid in the 3d Obſervation.

6. The Juice which deſcends by tapping, and which maketh the Pulp or Coat of any Fruit, aſcends by the Bark or Rind of the Plant, and not by the Pith. But I can affirm by many Experiments, that the Pith and the Timber have ſome Correſpondence with the Seed of the Plant, to convey an Intercourſe of the ſame Spirits and Nature from the Root to the Seed. Dr. *B.*

Dr. *T.* ſaith, That Piths are of a very different Nature and Subſtance; In the Walnut is a Multitude of Films, manifeſtly diſtant from one another; in others, as in *Elders* and *Bryars*, 'tis a continued ſoft, loſe, dry Subſtance.

7. The Points or Ends of the Roots being cut off, they will in Proportion bleed as copiouſly as the branches, and probably more, certainly longer, becauſe there is greater Plenty of Juice aſcended above them, than the Branches, and conſequently more will iſſue by them, than by any part of the Tree higher than them. Dr. *T.*

8. From the latter end of *Jan.* to the middle of *May*, Trees will bleed; thoſe that are ſaid to run firſt, are the *Poplar*, *Aſp*, *Abele*, *Maple*, *Sycamore*, ſome, as *Willows*, and the *Birch*, tried by my ſelf, are beſt to tap about the middle of the 2d Seaſon; and the *Walnut*, towards the latter end of *March*. They generally bleed a full Month in the whole. Mr. *Midford* of *Durham*, a very expert Gatherer and Preſerver of Saps, affirms, that the Saps of the *Poplar* and *Aſp* riſe ſo briskly in *January*, that they will bleed before the end of that Month; the *Sycamore* will run in hard Froſt, when the Sap freezes as it drops. Dr. *T.*

By Dr Tonge n.43. p. 862. n.44. p. 880. n.58. p. 1199

9. The beſt time of the Day for Tapping is about Noon. In the latter Seaſon, when Sap is not very plenteous in Trees, they will neither run Morning nor Evening, nor probably at any time of the Night; but when they are very full of *Sap*, and emptied but by very ſmall Vents, the Sap may run Night and Day till exhauſted, but never in large Vents. I have often obſerved, that when a large *Walnut* would yield no *Sap* any longer in the body or branches at any time of the Day, it would run longer at the Roots on the ſouth or ſunny ſide, than on the North or ſhady ſide, conſtantly governing the courſe of its Sap in its beginning to riſe, and to ſtop daily at the Riſing and Setting of the Sun.

10. Trees afford no Juyce at all (that has been obſerved) in *Autumn:* But Birch-Trees Bored in the Spring, ſo late, in reſpect both of the Year and Day, that they have afforded no Sap at all at the Body, have been found ſome time after, to have Iſſued ſuch Plenty of Juyce, as hath Condenſed in the Hole to a ſtiff Gelly.

11. Rain being ſcarce, the Juyce will be ſcarcer. Plenty of Rain can only give ſuch Plenty of Sap, as the Pores will admit. And too much Cold *Rain* may, by over-cooling, hinder the Sap, by abating from the degree of Heat neceſſary to the Pulſion of Sap into the *Root*, and to the Digeſtion in the Tree: which is alſo in Watering. On this Ground it ſeems probable, that drawing Sap conſtantly from Trees every Year, will not hinder their Growth, in Body, Branches, Leaves, nor Fruit, to any great Prejudice; for Pulſion will ſtill ſupply Juyce into the emptied Pores, till their Capacity be filled. It is alſo Poſſible, that Trees may grow better, and give more Fruit, if the right Art of drawing *Sap* be found out for that end; as ſome Perſons grow Fatter by often Bleeding.

12. In the Change of the Nature of a Tree, the Application of Juyces is, in my Opinion, not otherwiſe conſiderable than from the Scarcity, Plenty, n. 44 p. 877. or Goodneſs, of the Nouriſhment of ſuch Juyces; not from the Taſte, or Reliſh in them. Yet probably hot Nouriſhments, whether in Juyces or Earths, may digeſt the *Sap* and conſequently the Fruit better in Trees of Flaſhy Fruit, than in others; and *vice verſa.* In the mean time to change the Taſte of Fruit, the probableſt way may be thought not very hopeful to Bore the Roots and the Body, downwards and Tranſverſe, and to fill the Holes with Plenty of its own or ſome other Tree's Sap, in which ſome *Aromatick Subſtances* have been ſtrongly infuſed.

13. If no *Rain* come to the *Roots* of Trees at all, nor other Moiſture, they will not grow; but if the Points of the Roots only be watered, though all the reſt remain dry, (as it happens naturally in *Fir-Trees)* they may Grow very well. For the *Points* of the *Roots* ſhoot out yearly a ſharp pointed tender Part, ſomewhat like the Sharp Bud on the End of a Sprig, by which the *Root* not only enlarges it ſelf in the Earth, as the Branches do in the Air, but alſo receives its Nouriſhment: And that tender part moves its ſelf towards the beſt moiſtned and the tendereſt Earth. So that to promote the Growth of Trees, 'tis very effectual to looſen the Earth about the *Points* of the *Roots*; and there alſo to Miniſter *Nouriſhment* or proper *Liquors*; and this in trenches where the Amendment may remain, rather than above; throwing out the dead Mould out of the *Trenches*, and ſpreading it above to kill *Weeds.*

14. The *Roots* of *Plum* and *Lime-Trees Inoculated* upon, will ſhoot out their Buds, as I have experimented. I failed of Succeſs in the *Walnut*, in regard I think I had not well provided for what was neceſſary to keep the part *Inoculated* from the Moiſture of the Earth and Rain. To make a ſucceſsful Tryal, ſuppoſe in an *Alkermes-Oak* (a delicate Tree, and difficult to be otherwiſe *Inoculated* upon,) let the *Root* to be grafted on, be bared in the Fall of the Leaf, taken out of the Earth, and at convenient diſtance from the Body of the *Tree*, Bow'd, and raiſed a Foot above the Earth; and then the Points and

Fibres of the *Root* carefully laid about with freſh Earth, and Water'd till they take well, and till the *Root* raiſed in the Air have a Bark like that of a *Branch* of a *Tree*; which probably it will get in the next Seaſon of *Inoculation*. The *Inoculation* it ſelf is made on the part raiſed after the ordinary way. When 'tis done, let it be carefully covered with ſome ſoft Wax, as is known, to defend it from the *Rain*; it is to be ſtop'd, and order'd in all things, as in other *Inoculations*.

15. The Arms of the *Roots* of *Trees* are to be cut for the Advantage of their Growth, according to the proportion they have to their Head and Body; or according to the deſign you have to encreaſe Wood or Fruit. For ſuch *Roots* as are more outward, feed Wood, ſuch as are inward, the Fruit.

16. The Depth of *Trees* to be ſet, ſhould never be below the reach of the *Sun's* heat, nor the goodneſs of the Mould, and rather too ſhallow than too deep; for as much as they are apter to ſink lower, than to raiſe themſelves upwards, if they be out of the convenient reach of the *Sun*'s heat, the Cauſe of *Pulſion* and *Nouriſhment*.

17. The *Seeds* of *Fir*, *Pine*, *&c.* which bring up the *Shells* of their *Seeds*, upon the Heads of the firſt *ſhoot*, will either not grow at all, or difficultly, if the Blunt end be put downwards; becauſe in that Poſture it muſt turn it ſelf, before it can Emerge into the Air, for the *Root* is ſhot downwards at the ſharp end: But it may very well grow, if ſet Horizontally.

18. Such *Trees* as were mentioned in the firſt Obſervation, may grow, though no part of the *Root* be in the Earth. And all ſuch as may be propagated by ſhort *Sticks* cut off at both Ends, and laid in the Ground, as *Mulberries*, will do ſo. Some young *Plants*, if their Heads be kept moiſt, will live all Winter if mild, though their *Roots* be in the Air, as I tryed in *Seedlings* of *Apples* and *Crabs*. Their *Roots* ſet afterwards in the *Spring*, grew and lived. The Reaſon why ſome *Plants* grow in *Sticks*, may be the ſoftneſs of ſuch Wood, apt thereby to receive Nouriſhment like a *Root*, and to ſhoot out *Roots* and *Fibres* from themſelves. But in ſome Slips, taken from firmer Wooded Trees, as *Bayes*, a moiſt Temperate Seaſon is to be obſerved; and ſome Stone, or Chip of ſome Wood, to be cloſed to the end of the Slip, and ſet in the Earth with it, which helps its *Rooting*.

19. I am inform'd by a Curious and Intelligent Perſon, that the *Corruption* of Timber depends not upon the Time of the Year, and the Aſcent, or the Plenty or Scarcity of Sap, ſo much as upon the Seaſon of the Moon or Wind. And he affirms that Timber Trees Fell'd when the Wind is in the *Weſt*, eſpecially in the Old Moon, will keep them free from *Grubs* (as they call it) *i. e.* from being *Worm-eaten*; and on the contrary, that when cut down in an *Eaſt* Wind, the Worm will ſeize on them, in what Seaſon of the Moon ſoever it be fell'd. To prevent which Corruption, 'tis adviſed that ſuch *Timber* ſhould be forthwith thrown into Water.

20. *Ethelbert Jay*, an Ingenious and expert Planter in *Limſter*, ſuppoſeth, that the fitteſt time to Inoculate, is preſently after *Mid-Summer*, becauſe, ſaith he, the *Sap* Deſcends; but I ſay, becauſe 'tis then moſt plentiful, and begins to Jelly. The ſame aſcribes it to the *Sap* Aſcending, to take the *Bud*

Inoculated before *Midſummer*; and to the *Sap* Deſcending, to take it after *Midſummer*. The time he limits to a few Days before *Midſummer*, and to 8 or 10 Days after it. Mr. *Auſtin* limits 14 Days before, and as many after, and would have the Bud unty'd after 14 Days, as I remember.

It is all one, whether the *Sap* be exhauſted below, by being converted into Wood, Roots, and other uſes; or by Diverſion, as when the Branch is cut, or the Bark opened below: The *Sap* in both Caſes Deſcends, or rather ſinks indifferently, to ſupply the Defect, and heal the Wound, and ſo it comes to paſs, that there being about *Midſummer* the greateſt Plenty of Sap in Apple-Trees, a Bud then *Inoculated* will thrive, eſpecially before *Midſummer*; for then it draws its ſhare in the Sap Aſcending, and all the neceſſary Uſes of the upper Branches being ſerved, it partakes of the Flood of the abounding and ſuperfluous Sap, remitted to it from them.

21. My Friend informs me that to cut off the Head of the Stock, above the *Inoculated Bud*, will make a better *ſhoot*, than in the uſual *Inoculation*; if this be done a few Days before *Midſummer*.

22. If the Sap, in its *ſubſiding*, be conſiderable in the matter of *Inoculation*, it ſeems, that *Inoculation* will hold beſt and longeſt in Seaſon, in the *Root*.

For I have obſerved the Sap to *ſubſide* unto the Roots out of the Body at ſuch times of the Day and Year, when in the Branches I found none to ſpare.

23. To make a Barren Tree Bear again, Cheriſh it with Dung in trenches, and pare and renew the Extremities of its longeſt Roots, and cut off the outermoſt and ſhorteſt, neareſt the Body. Hence it may ſeem, that Plowing helps Fruit *Trees*.

24. *Croſs-Hackings* promote Fruitfulneſs, cure the *Phyllomania*, whereof the Reaſon ſeems to be, that (as was above intimated) outward Circles and Barks feed the Wood, and the inner only reach out to the outermoſt *Sprigs* of the laſt Year, to which the Fruit is Appendant. For ſome *Trees* Bear only on this Years *ſhoot*, and ſome only on that of the laſt, poſſibly ſome only on the third Years *ſhoots*; and ceaſe bearing when they ſhoot no new *Sprigs*. Seaſonable baring the *Roots*, which they call *Ablaqueation*, probably hath the ſame effect, becauſe it hinders the Nouriſhment eſpecially of the outward Coats, and of Bark, Leaves, and Suckers: But becauſe it ſeems that as ſome *ſuckers* or *ſhoots*, lately ſprung in outward Coats, robb the Fruit of the riſen Juice; ſo later Roots, come from the outward Parts of the main Roots, rob them alſo of their firſt Nouriſhment in the Earth. They ought to be Pruned, as well as all *Suckers* and *Not Bearing Branches* and *Sprigs*, every Year. For which Reaſon alſo Dung and other Amendments, as was ſaid above, ought to be applyed in *Trenches* nigh to, and beyond the fartheſt *Points* of the Roots, to draw them out of the *ſhade* and *drops*. To this end, diſtance and ſituation is to be obſerved.

25. One of the beſt Ways of obtaining the greateſt ſtore of Sap in the ſhorteſt time from the Body of any *Tree* is, not only to Pierce the Bark, nor to cut the Body with a *Chizel* almoſt to the Pith (as ſome have directed): but quite thorow all the Circles and the inner Rind it ſelf, on both ſides of

the Pith, leaving only the outermoſt *Circle* and the *Bark* on the North Eaſt ſide unpierced. But this Hole is to be bored Sloaping upwards, as large as the biggeſt *Augre* you can get will make; and that alſo thorough, and under a large Arm, near the Ground. So will it not need any Stone, to keep open the Orifice: nor Spigot to direct the Sap into the Receiver. This way the *Tree* will in ſhort time afford Liquor enough to Brew with: And with ſome of theſe ſweet Saps, one Buſhel of Malt will make as good Ale, as 4 Buſhels, with Ordinary Water; though you ſhould Brew even in *March*, held the propereſt time for Brewing, in regard of the goodneſs of the Water at that Seaſon. *Sycamore* I take to yield the beſt Brewing Sap, being very ſweet and wholſome.

26. To preſerve Sap in the beſt Condition for Brewing, what you gather firſt, muſt be Inſolated by a conſtant Expoſure of it to the Sun in Glaſſes or other fit Veſſels, till the reſt be gathered and ready; otherwiſe it will ſoon contract an *Acidity*. Having been thus expoſed to the Sun, till a ſufficient Quantity is collected; put into it ſo much very thin cut and hard Toaſted, but no ways Burnt, *Rye Bread*, as will ſerve to *Ferment* it; and when it Works take out the Bread, and Bottle the Liquor, ſtopping it up with waxed Corks: If you Bake Sage, or any other Medicinal Herbs, in ſuch thin *Rye-paſte*, till they be very dry, you may expect a very wholſome Drink. If you put a few *Cloves* in every Glaſs, into which the Sap runs from the Tree, it will certainly keep a Twelvemonth: But I have wondred, whilſt I obſerv'd how ſpeedily it drew the Taſte and Tincture of the *Clove*. In ſome few Bottles I was ſo happy as to draw out my *Cloves*, with a Cloth in which I ty'd them up, in ſuch a Seaſon, as not to change Colour nor Taſte; and yet I perſerved the Birch-Sap by that ſlight *Fermentation*, above a Twelvemonth without any Alteration, which elſe would have *ſowred* in a few Days.

27. Some propoſe Oil of *Sulphur* to perfume the Bottles with.

28. *Spirit* of *Wine* Ferments the Juyce of ſome Berries, and poſſibly may not only preſerve but advance the Vertue of *Saps*, a little being poured on the top of them in the Bottles; or ſome other *Oily-Spirit*.

29. *Raiſins* infuſed in the Liquor of Birch, is one ingredient of the *Durham* Gardner. I have been informed, that he uſes *Sugar*: But I believe, he puts it not in till he opens a Bottle preſently to be Drunk, becauſe it maketh the Liquor ſparkle in the Glaſs.

30. A certain Lady *Ferments* it with *Rye-Toaſt*, not put in, but only hung over it, in ſuch Quantity and at ſuch diſtance, as may give ſome light Warmth, Motion and Alteration to the Surface of the Liquor.

31. I *Fermented* ſome with Ale Barm, which converted my Delicate Birch Juice, kept in Bottles, into Pitiful ſmall Beer: Which I wondred at; for I knew one, who uſed, by the Barm of Ale, to improve ſmall Beer, and thereby to keep it the better in Bottles.

32. *Honey* will not mix with Cyder though boyled therein to make *Meath*: but after a while the Cyder lets fall the *Honey*, and becomes ſimple Cyder again.

33. Some affirm, that the tops and Leaves of Birch Decocted in the *Sap*,

will preſerve it from ſowring the whole Year; and that any ſort of dryed *Aromatick Herbs*, as *Sage*, *&c.* boyl'd in Beer, will keep it as well as *Hops*, *Ling*, (*Heath*) *Broom*, or *Worm-wood*. I had a Friend who uſed *Bay-Leaves* in his Beer and Ale.

34. The *Aſps* run only (as Mr. *Milford* relates) before *February*; the *Hop*, about *Hop Harveſt*, *Withies*, in *April*. n 58. p 1.09

35. In thoſe *Trees*, whoſe *Sap* ſeems to be of a *Gummy Nature* when condenſed, as *Plums*, *Cherries*, *&c.* I know no Experiment, by which any drop of *Sap* can be collected. And I ſuſpect, ſome other Fruit *Trees* to be of that Nature, whoſe *Sap* I could not draw out, at any Seaſon, of hot or cold Weather, though they have not been obſerved to yield any Gum. Perhaps there may alſo be ſome Fruit and other Trees, whoſe *Saps* are *Viſcous*, though not *Gummy*; and theſe, I doubt, will not yield any *Sap* to be gathered in any common or known way. n 68 p 2073

36. It is not Feaſible to gather all the *Sap* of thoſe Trees, whoſe Juice is Fluid and Plentiful, and Condenſeth into a Gelly; becauſe it ſeems at moſt Seaſons of the Year to Aſcend imperceptibly, and that not only in the outward, but innermoſt Parts and Pores of the Tree, not only betwixt Bark and Wood, but betwixt every Coat of the Wood, and even through the moſt ſolid Parts of each Coat, as Mr. *Willoughby*'s Obſervations have diſcovered. *Vid. Inf.*

37. An Eminent Planter in *Gloceſterſhire* has diſcovered to us, that by *Binding* the *Trees* round about very cloſely and ſtrongly with Cords, ſo as to Intercept what Riſeth 'twixt the Bark and the Body, he retards their *Bloſſom* and *Bearing*: And ſo may in ſome Years (when the open Weather haſtening *Bloſſoms* is like to deſtroy the Fruit) prevent a Scarcity of forward Fruit, uſually nipped by the late Froſts.

38. I kept ſome *Sap* in a large Retort of 2 or 3 Gallons, expoſed Night and Day (without any other ſtop than the Obliquation of the Retorts Neck, and a little Paper to keep out *Inſects*,) many Months, and it Contracted a Coat on its top; the Taſte pleaſing my Palate, I adventured to Brew with it at Cyder Seaſon, and made a good Quantity of good Cordial Drink, with 8 Buſhels of Chopt Apples, Brewing them like Malt with hot Water, and puting my Juices and Saps into my Water Cyder at the latter end of their Boyling. I filled a Stand with it, which contained half the Quantity of the largeſt *Rheniſh Wine* Veſſel, *viz.* about 40 Gallons, as I remember I had not half Sap in this Liquor (the greateſt part of my Brewing being made with Water,) yet I got 5 Gallons and more of Warming Cordial and Pleaſant Drink for every Buſhel of my Apples. If it had been all Sap, it would have been much more Cordial and Strong. There was in it a conſiderable Quantity of Juice of *Borrage-Roots* and *Herbs* (at that Seaſon uſually thrown out of Gardens,) which *Borrage Liquor* Works and Purges it ſelf when Tunned, and turns into an excellent clear brown Liquor. I drank my Drink in *Eaſter* following: So my Sap gathered at *Spring*, and Brewed about *Michaelmas* continued good till *Eaſter*, and after it. ib. p. 2075.

39. Some affirm, that the Dividing of Crab-Stock-Roots, from the Stem left in the Ground, is the beſt way of Multiplying Crab-Stocks, or a Commendable one at leaſt.

40. 1. I have heard that a Chip of Soft-Wood, laid to the end of a *Bay-Slip* promotes its Rooting: And that *Mulberry Slips* are eaſily Propagated, ſet in the latter end of *January*, or beginning of *February*, in a moiſt Seaſon, not in a dry *March*. Such *Slips* Root beſt, if they be *ſuckers*, and taken off with part of the old Bark; or if they be laſt Years *ſhoots*, cut off from *Arms*, taken with ſome older Bark from the place where they ſhot out. I have ſet many formerly, which all throve. I affect to Propagate them for Pear, and other Stocks, namely *Quinces*, *Medlars*, *Plums*, to turn their Pulp and Juices red, by taking Grafts from ſuch *Trees* as have been Grafted on *Mulberries*. Perhaps the Blood Red Pears and Red-Redſtrakes were thus raiſed at firſt, or may be thus Propagated to Advantage.

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2. 1. In *Birch Trees*, the Sap iſſues out at the leaſt twigs of Branches, and Fibres of Roots, in proportion to their Bigneſs.

2. In all *Trees* the Gravity promotes the Bleeding, ſo that from a Branch or Root, that Bends downward, there will iſſue a great deal more Sap, than from another of the ſame bigneſs in a more Erect Poſture.

3. Branches and young Trees cut quite off when they are full of Sap, and held Perpendicularly, will Bleed, as we experimented in *Willow*, *Birch*, and *Sycamore*: And if you cut off their tops, and *Invert* them, they will Bleed alſo at the little Ends. Hence one may conjecture, that the Narrowneſs of the Pores is not the ſole Cauſe of the Aſcent of the Sap; for, Water that hath Aſcended in the little Glaſs Pipes, will not fall out again by its own Gravity, if the Pipes be taken out of the Water.

4. Roots of *Birch* and *Sycamore* cut aſunder will *Bleed* both ways, that is, from that part remaining to the Tree, and from the part ſeparated: But a great deal faſter from the part remaining to the Tree. But in a Cold Snowy Day the Root of one *Sycamore*, we had bared, bled faſter from the part ſeparated; and ten times faſter than it did in *Warm* Weather before.

5. In *Birches* the Sap does not iſſue out of the *Bark*, be it never ſo thick, but as ſoon as ever you have cut the *Bark* quite through, then it firſt begins to *Bleed*.

6. The *Bark* being quite pared off above an Hands breadth round, about ſeveral *Birches*, did much abate the *Bleeding* of the Trees above the bared places, but did not quite ſtop it.

7. The Sap doth not only Aſcend between *Bark* and *Tree*, and in the *Prick Circles* between the ſeveral *Coats* of Wood; but alſo through the very *Body* of the Wood. For, ſeveral young *Birches* being nimbly cut off at one blow with a ſharp Axe, and white Paper immediately held hard upon the top of the remaining Trunk, we ſtuck down Pins in all the points of the Paper as they appeared *Wet*; and at laſt, when the moſt of the Paper became *Wet*, taking it away, but leaving the Pins ſticking, we found them without

any Order, ſome in the *Circles*, and ſome in the *Wood* between. And to confirm this further, we cauſed the Body of a Tree to be cut off aſlope, and then cut the Oppoſite ſide aſlope likewiſe, till we brought the top to a narrow Edge; ordering the matter ſo, that the whole Edge conſiſted of part of a *Coat* of *Wood*, and had nothing of a Prick'd Circle in it, which notwithſtanding, the Sap aſcended to the very top of this Edge, and wetted a Paper laid upon it.

8. To find out the Motion of the Sap, whether it Aſcended only, or Deſcended alſo, we bored a hole in a large *Birch*, out of which a drop fell every *4th* or *5th* Pulſe. Then, about a Hand's breadth juſt under the Hole, we ſaw'd into the Body of the Tree, deeper than the hole: Whereupon the Bleeding diminiſhed one half; and having ſaw'd juſt above this hole to the ſame depth, the Bleeding from the hole ceas'd quite; and from the ſaw'd Furrow below decreaſed about half: And it continued Bleeding a great while after at both the ſaw'd Furrows, the Hole in the middle remaining dry. We repeated this with much the like Succeſs upon a *Sycamore*.

9. Some Trees of the ſame kind and Age Bleed a great deal faſter and ſooner than others; but always old Trees ſooner and faſter than young.

10. A Wound, made before the *Sap* Riſes, will *Bleed* when it doth riſe.

11. While we were making theſe Experiments, the weather changed from *Warm* to very Cold; whereupon the *Bleeding* in the *Birches*, which begun to abate before, ceas'd quite: But all the *Sycamore* and *Walnut Trees*, we had wounded, bled abundantly; (ſome whereof bled not at all, and thoſe that did, did ſo but ſlowly;) and ſo continued Night and Day, when it Froze ſo hard, that the *Sap* congealed as faſt as it iſſued out. The Cold remitting the *Birches* bled afreſh, the *Sycamores* abated very much, and the *Walnut Trees* quite ceaſed.

12. We pierced two *Sycamores* on the *North* and *South* ſides, and both of them from equal Inciſions bled a great deal faſter from the North ſides, than the *South*; which is Conſonant to the Preceeding Experiment.

13. We ſet ſeveral *Willows* with the wrong Ends downward, and cut off ſeveral *Bryars* that had taken Root at the ſmall Ends. This *29th* of *May* 1669. the *Willows* have ſhot out *branches* near two Foot long, and from the top of the Sets, which were a Yard high: the *Bryars* have alſo grown backwards, from that part which we left remaining to the Roots at the leſſer Ends; they have great Leaves, and are ready to Flower.

14. Dr. *Tonge* found, by his Experiments in the *Roots* and *branches* of Trees, that not only Cold Weather but Cold Wind and Sunſetting ſtopped or abated the Motion of *Sap* in the *Sycamore*: But his Experiments were made in *February*, and ours towards the end of *March*. The Cold which cauſed that increaſe of the *bleeding* in the *Sycamore* and *Walnut*, happened upon the 23, 24, 25, 26. of *March*; and one *Sycamore*, which ceaſed to *bleed* from the *11th* of the ſame Month, bled afreſh copiouſly from Wounds that had been made ſo long before. The *Buds* before the Cold, were juſt ready to open into Leaves, and the *Sap* had begun to Coagulate above a Fortnight before. In *January* 16$\frac{69}{70}$ making Inciſions in the *Sycamore* and com-

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mon *Maple*, immediately upon the relenting of the firſt Froſt, we found that they both bled, and faſter, as the Weather grew Hotter; nor did the ſucceeding Cold promote, but rather hinder their *bleeding*. So that the learned Dr. doth moſt ingeniouſly Conjecture, that the Aſcent of the *Sap* in Trees, depends upon a certain Degree of Heat, ſufficient to raiſe, but not to Coagulate their reſpective Juices. In thoſe Months, wherein the Heat ordinarily falls ſhort of that Degree an Accidental Heat or Warmth of Weather promotes the *bleeding*; but in thoſe Months, wherein the ordinary Temper of the Air exceeds that Degree, an extraordinary fit of colder Weather makes them *bleed* again.

15. In *Walnut Trees*, we never yet found, that Heat promoteh their *bleeding*, but always Cold. From a Wound made in a *Walnut Tree* in *January*, and the beginning of this preſent *March* 16$\frac{69}{70}$, in mild Weather, nothing iſſued; but the Weather changing and growing Colder, it bled plentifully.

16. *March* 11. 166$\frac{8}{9}$ Roots of *Birch*, great and ſmall, bled both ways; and about the ſame time, *Sycamore* Roots alſo. The ſame *Birch* which firſt began to bleed, *March* 3. 16$\frac{69}{70}$. bled three Weeks ſooner the Year before.

17. It was obſerved in *Autumn* 1669 by Mr. *Mart. Liſter*, that upon the firſt Froſt, which happen'd in *November*, a *Sycamore* bled copiouſly; ſo that the Sap cannot be ſaid to riſe in *January*, but immediately after the Fall of the Leaf, in this *Tree*.

N.58.p.1199 18. After the Leaves were Explicated in the Year 1670, we obſerved the *Sycamore*, after ſeveral Froſty Nights to *bleed* afreſh in the Morning, ſoon after Sun-riſing, when it had ceaſed ſeveral Days before; though this muſt not be underſtood of all *Sycamores*, but of ſome only that are more ſenſible and obſervant of the Weather.

April 3, and 4. all the *Sycamores* quite ceaſed.

The 5th being after a White Froſt, they began to *bleed* about 8 a Clock, and ceaſed towards Noon.

The 9, 12, 13, 15, they bled again.

The 16, they bled not, it being Rainy, and the Sun not ſhining.

From the Obſervations we have hitherto made, we think it may be certainly inferr'd, that a Morning Sun after a Froſt, will make all the *bleeding Tribe* bleed afreſh, though they had before ceaſed, and that this new *bleeding* towards the latter end of the Seaſon commonly ceaſeth before Noon. Poſſibly ſome may bleed after a Froſt, yet further in the Summer.

19. I obſerved in *Auguſt*, a Copious and ſpontaneous Exſudation, very like *bleeding*, of a Viſcous Yellow Juice out of the *buds* of a black *Poplar*.

20. Our *Walunt Trees bleed* here at *Middleton* in *Warwickſhire* in *January*.

† Dr. Tonge 68.p.2070 21. I am very much confirmed in my Apprehenſions, that Trees and other Plants, if we could Contrive them, as I have (but ſlenderly) projected in my Sap-wiſer to that purpoſe, would far better indicate the

Alteration of Weather, as to Heat, Cold, Moiſture, Drought, than any *weather Glaſſes* I have yet experimented. For my *Weather Glaſs* continuing at one and the ſame ſtation in a manner all this Day (*April* 13, 1670) my trees have altered their temper ſo much, that 24 of them that ran tolerably this Forenoon, yield not a Pint of Sap this Afternoon; and tho' one of them ran moſt part of the Day, the reſt ceaſed about one or two of the Clock in a fair, clear, ſun-ſhiny Seaſon, retarded (ſo far as I could obſerve) only with a Weſtern Wind, tho' that be reputed mild and cheriſhing.

Theſe Trees ran above 2 Quarts in the Morning, the Weather-Glaſs continues the ſame, viz. about 11 Inches Water theſe two Days. *Thurſday* 14. it was $9\frac{1}{2}$ only.

Friday 15. My *Weather-glaſs* at Noon was advanced from 9 to $10\frac{1}{2}$, yet the quantity of *Birch Water* this Day exceeded my former from theſe trees, for I had above $2\frac{1}{2}$ Quarts before Noon.

But for Cold, I find that the Air, when any whiſtling Blaſt of cold Wind ſtirs, ſtays my Birches.

Saturday, *April* 16. Theſe 24 *Birches* began to run preſently after Sun-riſe, and ran about 3 Quarts, and ceaſed about 2 a Clock after Noon, having till then continued to run.

Sunday 17. It rained ſo, that we could make no Obſervations what Sap theſe trees might ſpend; neither did Rain and all amount to much above a *Gallon* and a half. *Monday* 18. they ran until Noon. *Tueſday* and *Wedneſday* the 19 and 20, wherein was expected greater Store of Sap, after the Rain, the trees ſpent not a Drop.

Saturday April 23, My *Weather-glaſs* ſtood at $7\frac{1}{4}$, it being a rainy and boiſterous Morning, the Rain not allaying the Wind. At 9 a Clock of that Forenoon, my *Birch Water* worked in the Barrel, *per ſe*, which ſeems to verify Mr. *Souton*'s Relation from his Brother, a *Swediſh* Merchant, importing that *Birch water* in *Sweden* worketh alone (perhaps collected in great Quantity.) Only I put a few *Cloves* into my Sap, boil'd to a third or leſs, it keeps well; eſpecially when boil'd with the buds or ſprigs of the ſame tree, as I have been informed.

April 16, 17, 18. In the Year 1670, *Birch-ſap* mixed with *Rain Water* at the tree, fermented with *Roſemary-ſprigs*, ſteeped in *Spirit* of *Wine*; which warmed the Stomach as ſtrong Wine, and pleaſed the Palate; though the taſte in the Mouth was ſomewhat wateriſh.

22. We find that branches of *Willow*, *Birch*, and *Sycamore*, cut off and held perpendicularly, will bleed without tipping, and that the cutting off of their tops does not ſenſibly promote the bleeding.

*, Mr. Fr. Willoughby n.70.p 2125 *Vid. inf.*

We doubt not of Mr. *Liſter's* Diligence and Veracity, and wonder our Experiments ſhould differ. The *Sycamore* bleeds upon the firſt conſiderable Froſt, after the Leaf is fallen, as it did plentifully *Nov.* 16. 1670. And both that, *Walnut* and *Maple* bleed all Winter long, after Froſts, when the Weather Relents, and the Sun ſhines out; but *Walnut* and *Maple* begin not ſo ſoon as the *Sycamore*. The *Birch* will not bleed till towards the Spring. *An*

167$\frac{0}{1}$. it began ſomething ſooner than ordinary, about the beginning of *Feb.*

Ib. p.2142. 23. In a very ſharp *Froſt* the *bleeding* is ſtopt till the Weather begins to change, but in a moderate Froſt, tho' it ſtop in the Night, yet in the Day-time, if the Sun ſhines out, the trees will bleed tho' the Froſt continue. What we ſaid formerly that Cold did not promote, but hinder bleeding, we find holds true, if the Cold be without Froſt.

Ib. p.2126. 24. We cut off pretty big branches of *Birch*, and having tip'd the Ends, inverted them, and faſtened a *Limbus* or Ring of ſoft Wax to the great Ends, which we held upwards, making with the Plane of the End, a Veſſel of about an Inch deep, whereinto we poured Water, which in a few Minutes ſunk into the Pores of the Wood, and running quite thro' the Length of the Branch, dropped out of the Ends conſiderably faſt, continuing ſo to do as long as we poured on Water. The like Experiment we made by faſtening ſuch Rings of Wax to the leſſer Ends, and pouring in Water, which ran thro' the Wood, and drop'd out of the greater Ends as faſt or faſter; this we tried
Ib p. 2142. once upon a *Sycamore* without ſucceſs; but afterwards I made trial both upon *Sycamore* and *Walnut*, and found that Water runs thro' both, but nothing ſo faſt as thro' Birch.

By Dr. Liſter, n.68.p.2067. n.70 p.2120 2126. 3. 1. About the Beginning of *Nov.* 1669, I pierced a *Sycamore* growing in a ſandy Soil at *Nottingham*, the turgeſcence of the Buds inviting me thereto, and engag'd my keeping a *Journal* till the latter End of *March* following: from which *Journal*, I think I may note, 1. That the wounded *Sycamores* never bled, neither in *November* nor *December*, nor *January*, nor *February*, nor *March*, (which yet they did above 40 ſeveral times, that is, totally ceaſing, and then beginning a-new,) unleſs there preceeded a ſenſible and viſible Froſt; for I had no other way of recording the temper of the Air. 2. That the Froſt did not always ſet a bleeding the Wounds they found made before they came, tho' ſometimes they did; but upon their breaking up, or very much relenting, the Wounds, either made at that Inſtant of time, or made many Months before, did never fail to bleed more or leſs. 3. That particularly upon the breaking up of the 2 great and long Froſts, (the firſt of which happened that Year in that Country to be on the 3*d.* of *January*, the ſecond about the 12, 13 and 14 of *Feb.*) all the Wounds ran moſt plentifully, ſo that ſuch times may be looked upon as the moſt proper Seaſon of gathering great Quantities of Juice from this tree.

2. In *May*, 1670, I wounded ſome *Sycamores* in *Craven*, but they did not bleed, neither the remaining part of that Month, or the following Months of *June* and *July*; but had the Orifice of the Wounds, made with a ſmall Augre, in a manner quite grown up, and would ſcarce admit a *Pigeon's* Feather. Wherefore the 30 of *July*, I cut out a ſquare piece of about 2 Inches of the bark of a large and well grown *Sycamore* about my height, in the Body of it. This Wound began to run next Morning about 9 a Clock, ſo as to drop, and that was all, and dried up by 11 in the Morning; the like Cut I made in a young *Sycamore*, the 8*th* of *Auguſt*, which in like manner bled the next Morning, but ſtopp'd before 9 a Clock. It did ſo for 2 or 3 Days; but then totally dry'd.

3. *Nov.*

3. *November* 1, 1670. Here at *York* I pierced and otherwiſe wounded 2 *Sycamores* growing in a wet *Clay*, but they never ſtirr'd till the beginning of *February* following. Yet Mr. *Wray* hath aſſured me, that thoſe of *Warwickſhire* bled the 16*th* of *Nov.* copiouſly, and afterwards the *Walnut-tree* alſo.

I am apt to think that the Sap in all parts of the tree at the times of this anomalous Bleeding is ſome ways notably altered in its temper and conſiſtence: And this Bleeding by ſtreſs of *Weather* may in theſe trees probably be look'd upon as a Violence done to their Natures from an unkind Climate, conſidering the *Walnut* and *Sycamore* as Strangers, and not *Natives* of *England*. 'Tis indeed true, there are many ſorts of *Engliſh* Plants, which will bleed in Winter; but note alſo, that ſuch Plants never refuſe to do ſo at any time of the Year, no more than a Man, who may bleed a Vein when he pleaſeth.

4. *Feb.* 1. 1670-1, it froze, the Wind at *North*, the Froſt and Wind continued (ſome little Snow and Rain falling) the 2, 3, 4, 5, 6, until the 7. in the Morning, when the Wind came about to the South-Eaſt, and the Weather broke up apace. The *Sycamores* bled not all this while, but the 7 about Noon all trees of that kind bled very freely, both at the twigs and body, and I ſtruck above a Dozen.

At this ſame critical Seaſon, I alſo ſtruck the *Hawthorn*, *Hazel*, *Wild-Roſe*, *Gooſeberry-buſh*, *Apple-tree*, *Cherry-tree*, *Blather-nut*, *Apricock*, *Cherry-Lawrel*, *Vine Walnut*; yet none bled but the laſt named, and that faintly in Compariſon of the *Sycamore*.

Feb. 11. All was here covered with a white Froſt betwixt 9 and 11 in the Morning.

The Weather changing, I made the Experiments which follow, upon the *Sycamore*, *Walnut*, *Maple*. A Twig cut aſunder would bleed very freely from that part remaining to the Tree; and for the part ſeparated, it would be altogether dry, and ſhew no Signs of Moiſture, although we held it ſome pretty time with the Cut-end downwards; but if this ſeparated Twig was never ſo little tipp'd with a Knife at the other End, it would forthwith ſhew Moiſture at both Ends: the ſame Day, late in the Afternoon, the Weather very open and warm, a Twig cut off in like Manner, as in the Morning, would ſhow no Moiſture at all from any part. But I have ſince been convinced, that 'twas rather ſome unheeded Accident which cauſed this new Mo- ib. p. 2125.
tion of the Sap, than meerly the ſtriking off their Tops.

5. Becauſe Sap is ſaid to aſcend from the Root; when it is found to move ib. p. 2123.
in Tapping, I lopp'd off certain Branches of a *Sycamore*, the Morning betimes of a hard Froſt (*Feb.* 21) before they would bleed, or ſhew any Sign of Moiſture. And not willing to wait the Change of the Weather, and the Sun's Heat, I brought them within the Air of the Fire, and by and by, as I expected, they bled apace, without being ſenſibly the warmer.

This Experiment repeated, afforded me divers *Phænomena*, which follow; and prov'd almoſt an univerſal way of bleeding all ſorts of Trees, even thoſe which of themſelves would not ſhew any ſigns of Moiſture.

1. *Poles* of *Maple*, *Sycambre* and *Walnut*, cut down in open Weather, and brought within the Warmth of the Fire did bleed in an Inſtant. Alſo *Willow*, *Hazel*, *Cherry*, *Wood-bind*, *Blather-nut*, *Vine*, *Elder*, *Barberry*, *Apple-tree*, *Ivy*, *&c. Whicking* and *Egge-berry tree*, (i. e. *Padus Theophraſti*) tried in the ſame manner in *Craven*.

2. *Briar* and *Rasberry*-rods were more obſtinate; *Aſh* utterly refuſed, even heated hot.

3. *Branches*, that is, *Poles* with their *Tops* entire and uncut, bleed alſo when brought to the Fire ſide; but ſeem not ſo freely to drink up their Sap again when inverted, as when made Poles.

4. The ſame *Willow Poles* left all Night in the Graſs-plot, and return'd the next Day to the Fire ſide, bled afreſh.

5. *Maple* and *Willow-Poles* bleed and ceaſe at pleaſure again and again, if quickly withdrawn and balanced in the Hand, and often inverted to hinder the Falling and Expence of Sap; yet being often heated, they will at length quite ceaſe, tho' no Sap was at any time ſenſibly loſt. And when they have given over bleeding, that is, ſhewing any Moiſture, by being brought within the Warmth of the Fire, the Bark will yet be found very full of Juice.

6. An hard Ligature made within a quarter of an Inch of the End of a *Wood-bind* Rod did not hinder its bleeding at all, when brought within the Warmth of the Fire.

7. *Maple* and *Willow Poles*, &c. quite Bared of *Bark*, and brought to the Fire, will ſhew no Moiſture at all in any part.

8. One *Barberry* or *Pipridge-pole*, bared of its Bark, brought to the Fire, did ſhew Moiſture, from within the more inward Circles, though not any from the outward.

9. *Maple* and *Willow-poles*, &c. half bared of Bark, would bleed, by the Fire, from the half only of theſe Circles, which lay under the Bark.

10. *Maple* and *Willow-poles*, ſplit in two and planed, would not ſhew any Moiſture on the planed Sides, but at the Ends only.

11. A *Pole* of *Ivy* did of it ſelf exſudate and ſhew a liquid and yellowiſh *Roſin* from the Bark and near the Pith; but when brought to the Fire-ſide, it bled a *Dilute*, thin and colourleſs Sap from the intermediate Wood Circles.

12. A *Pole* of *Willow* (for Example) bent into a Bow, will ouſe its Sap freely, as in bleeding either ſpontaneouſly or by the Fire.

Ib. p. 2126. 13. One or both Ends of the Pith of a *Willow Pole*, ſeal'd up with hard Wax, will yet freely bleed by the Warmth of the Fire.

14. *March* 23, 167$\frac{0}{1}$, was the greateſt Froſt and Snow we have had this winter in theſe parts about *York*, when ſome Twigs and Branches of the very ſame *Willow-tree* as formerly, and likewiſe of many other *Willow-trees*, taken off that Morning, being brought within the Air of the Fire, would ſhew no Moiſture at all; no not when heated warm, and often and long turned.

15. *Mar.* 24. The ſame *Willow-branches*, which the day before would not bleed, and were thrown upon the *Graſs-plot* all Night, did, both they and other

new cut down, by the Fire ſide freely ſhew Moiſture, and bleed in the Morning upon the breaking up of the Froſt.

16. *Aſh-Poles* and Branches that Day and the Day before, would by the Fire be no more moiſt, than when I formerly tried them.

17. The ſame Morning, a Twig of *Maple* which had had the Top Cut off the 7 of *Feb.* (and which then bled) being quite taken off from the Tree, and brought within the Air of the Fire, and held with the formerly cut End downwards, did not run at all at that End, but held on in that Poſture, it did run apace at the other new cut End uppermoſt, ſo as to ſpring and trickle down.

Note, That this doth well agree with my Experiments made the Year before at *Nottingham*, where I obſerv'd Wounds of ſome Months ſtanding, to bleed apace at the breaking up of every hard Froſt. For 1. in theſe Parts there hath been no hard Froſt this Year; not comparable to that Year. Again, thoſe *Nottingham-trees* I wounded in the *Trunk*, and they ſtood againſt a Brick Wall, and the Wounds were on the Side next it; and beſides had Horſe-dung ſtopt in all of them, for ſome Reaſons, which things did undoubtedly defend them much from the air and winds, and keep the Wounds ſtill green and open; whereas the Tops of theſe *Maple-twigs* ſpoken of in the laſt Experiment, were expoſed in an open Hedge to the Air and Winds; as alſo the 2 *Sycamores* here at *York*, mentioned above to have been Wounded in *Nov.* 1670. and not to have ſhew'd any Signs of Moiſture, for that very Cauſe, that they were not freſh ſtruck at Bleeding Times.

The Circulation of *Saps*, by Dr. M: Liſter, n. 70. p. 2122,

LXI. I am inclined to think, that there is ſome kind of *Circulation* of the *Juices* of *Vegetables*; 1. Becauſe I find, that all the Juice of a *Plant* is not *extravaſate* and looſe, and like Water in a *Spunge*, but that there are apparent Veſſels in Plants, Analogous to Veins in Animals, which thing is moſt conſpicuous and clear in ſuch Plants, whoſe Juice is either White or Red, or *Saffron* coloured; for Inſtance in each Kind of Juice, we propoſe *Lactuca Atractilis*, *Chelidonium majus*. 2. Becauſe that there are very many Plants (and theſe laſt named are of the Number) whoſe Juice ſeems never to be at Reſt, but will ſpring at all Times, freely as the Blood of Animals, upon Inciſion.

The Way of *Ligature* by *metalline Rings*, is an *Expedient* I have not uſed; but other *Ligatures* I have, upon a great Number of our *Engliſh Plants*, not without the Diſcovery of many curious *Phænomena*. The ſucceſs of an Experiment of this Nature upon *Catapucia minor Lobel* was as follows; I tied a Silk thread upon one of the Branches of this Plant as hard as might be, and not break the Skin. There followed no greater *Swelling* that I could diſcern, on the one Side of the Silk than on the other; although in often repeating the Experiment, ſome Silks were left Hours and Days unlooſed; and yet the Dimple which the Thread had made in the yielding Branches, had a little raiſed the immediate Sides but both alike. The Plant in like Manner would bleed very freely, both above and under the Tye. This was alſo, I thought, very remarkable, amongſt other things, in this Experiment, that in Drawing the *Razor* round about the Branch juſt above or below the Ty the *milky* Juice would ſuddenly ſpring out of infinite ſmall Holes, beſides the made *Orifice*, for more than half an Inch above and below the *Tye*, which ſeems to argue, that though there was no Juice intercepted in Appearance from any Turgeſcence, as in the Proceſs upon the Members of a *ſanguineous Animal*, yet the Veins were ſo over-thronged and full, that a large *Orifice* was not ſufficient to diſcharge the ſudden *Impetus* and Preſſure of a ſomeways ſtreightned *Juice*.

The Deſcent of Sap in Winter, by Mr. Rich. Reed, n. 70. p. 2129.

LXII. 1. To prove that the *Sap* does deſcend in *Winter*, I have obſerved, that the *Graft* hath Influence either to corrupt or to heal the *Stock*: nay, farther, to alter and change the very Nature and Way of the Growing of the *Root* in the Earth, which I cannot ſee how it ſhould do, but by ſending down its Sap thither. I have by certain Obſervation found, that *Crab-ſtocks* grafted with ſome ſorts of Fruits, which the Soil liketh not, they, not the Soil, will (not one or two, but all of that ſort) *Canker*, not only in the *Graft*, but the *Stock* alſo; which if you Graft again, upon the former Graft, with a Fruit liking to the Soil, will all heal, and ſo become Trees. And further, Certain it is by my Obſervation, that 20 *Pear-ſtocks* being wild, grafted young with the ſame ſort of Pear, and 20 with another, the *Roots* of each of them of one ſort will grow alike, and ſo thoſe of the other. Generally, thoſe that naturally grow high, as the *Bare-Land-Pear*, root deep, and all do ſo: Thoſe whoſe Heads are buſhy and thick, as the *Summer-Bonchreſtien*, their Roots run wide, and are matted below, and all are ſo. This Diverſity of the Way of growing of the *Root*, muſt be by grafting: and could not be but by the Intercourſe of Sap, which it receiveth from the Graft, and that cannot be, but by the Return of Sap.

By Dr. J. Beal, n. 71. p. 2144.

2. 'Tis no Wonder if the Effects which Mr. *Reed* mentions do follow from that Correſpondence in all Parts of the whole *Plant*, which is by me acknowledged, eſpecially, ſince by the Leaves and all the Pores in the Branches and Body, the Plant draws a kind Suſtenance from the Sun, Air, and Dews, as by the Roots from the ſucculent Soil. And as the *Channels*, which I may call the Conduits and Strainers, of ſeveral Stocks and Coyns do differ, ſo may ſome Change of the Liquor be made by ſeveral Kinds of Diſtillation. And from the fore-noted Difference of *Stocks*, and the Differing Grains of the Roots and Timber, as alſo from the Differing Leaves, if accurately inſpected, and conſider'd, we may in time perhaps Diſcover ſome particular Cauſes of the Differing Sap, Fruit and Bloſſoms.

'Tis about 15 Years ſince I publiſhed a Hint, how to diſcover by the Colour, Figure, Tenderneſs and Aſperities of the Leaves of young Apple-Plants and Crabs, firſt appearing in the Spring, which Plant would yield the more delicate, and which the more auſtere Fruit and Liquor, to ſeveral Kinds and Degrees of Delicacy and Auſterity; Flatneſs and Inſipidneſs, and Vigour and Briskneſs. And this, I think, allows a Conſideration for ſome Efficacy, or Sign, at leaſt, of Change or Operation in the Deſcent of Sap. But as far as I dare, or did, deny the Deſcent of Sap, I meant it in the vulgar Senſe of that Expreſſion, *viz.* the main Quantity of Sap which Aſcends in the Spring, and is gradually hardened into Leaves, Bloſſoms, Fruit, Timber, in ſuch Manner as the *Oſſification* in young Animals, is deſcribed by Dr. *Kerckringius. Anthrop. Ichn.* 'Tis a large Quantity of Sap, which is expended on the Fruit and Growth of ſome *Trees*, on *Acorns*, *Walnuts*, *Cheſnuts*; and this returns not to the *Root* in *Winter*: Yet conſiſts well with the Sentiment of the Circulation of the Sap, which in ſome Seaſons may run the Round more ſwiftly than in other.

Veins in Plants obſerved by D^r. M. Liſter, n. 79. p. 3052.

LXIII. 1. Some Years ago, I made a few Obſervations concerning the *Veins* or ſuch *Ductus*'s, as ſeem to contain and carry in them the nobleſt Juices of *Plants*; and I am of the Opinion that they will prove *Veſſels analogous* to our Humane Veins. Thoſe Parts of a Plant, which *Pliny* calls by the names of *Vena* and *Pulpa*, are nothing elſe in my Opinion, but what Dr. *Grew* calls *Fibres* and *Inſertments*, or the Lignous Body interwoven with that which he takes to be the *Cortical*, that is, the ſeveral Diſtinctions of the Grain. But that theſe Veſſels are not any of the Pores of the Lignous Body (to uſe the Doctors Terms) is plain in a tranſverſe Cut of *Angelica Sylveſtris magna vulgatior*, *J. B.* For Example; the Veins there very clearly ſhew themſelves to an attentive View, to be diſtinct from Fibres, obſervable in the *Parenchyma* of the ſame *Cortical* Body together with themſelves; the *milky Juice* ſtill riſing beſides, and not in any *Fibre*. Alſo in the like Cut of a *Burdock* in *June*, the like Juice ſprings on this and on that Side of the *Radii* of the Woody Circle, that is, in the Cortical Body and Pith only. Again, where there is no Pith, there is none of this Juice to be obſerved, and conſequently none of theſe Veins; as in the Roots of Plants, and Trunks of Trees; but ever in the Bark of either. Theſe Particulars are plainly obſervable in the *Spondylium*, *Cicutaria*, many of the *Thiſtle* kind, &c.

Further, neither are they probably of the Number of the *Pores*, deſcribed by Dr. *Grew* in the *Cortical Body*, or *Pith*: Not ſurely of thoſe Pores extended by the Breadth, becauſe the Courſe of the Juice in theſe Veſſels, is by the Length of the Plant; as I have ſometimes very plainly traced in the Pith of a dry'd *Fennel-Stalk*, following them by Diſſection quite thro' the Length of the *Pith*. It remains, that if Pores, they are of thoſe Pores of the *Cortical* Body, that are ſuppoſed to be extended by the Length thereof; which yet ſeems (to me at leaſt) not enough: But we think them Veſſels inveſted with their own proper Membranes Analogous to the Veins of our Humane Body; for theſe Reaſons, 1. Becauſe they are to be found in the Pith, and ſometimes in the *Cortical* Body of a Plant, not included within the common Tunicle of any Fibres, as is above noted. That Fibres, or the Seminal Roots are cloathed, is moſt plain in ſome Plants, as in

Fern and *Geranium Batrachoides*; the *Fibres* of the former are coated, at leaſt in ſome Parts of the Plant, with a black Skin, in the latter likewiſe with a red one, and in theſe Caſes, had they not, I ſay, their own proper Membranes, we ſee no Cauſe why the very porous and ſpongy Body of the *Pith*, and *Cortex* ſhould not be in all Places fill'd alike with the Juice, and not riſe (as moſt plainly it doth) in a few determinate and ſet Places only, that is, according to the Poſition and Order of theſe Veſſels. 2. Again, the Experiment I made concerning the Effect of a Ligature on *Catapucia minor Lobel*, *viz.* The ſudden ſpringing of the milky *Juice* out of infinite Pores beſides the Inciſion, (The Cauſe of which Phænomenon, I take to be the diſſected Veins impetuouſly diſcharging themſelves of part of their *Juice* within the porous *Parenchyma* of the Bark; whence it is probable, that if there was no Coated Veſſel to hold this milky *Juice*, we might well expect its ſpringing upon the bare Ligature, as when we ſqueeze a Wet Sponge, the external Cuticle of the Plant, as this Experiment ſhews, being actually perforated.

Vide ſupra, § LXI.

In the next Place, it is very probable, that theſe Veſſels are in all Plants whatſoever. For, as it is truth-like of all the other ſubſtantial Parts of Plants that they are actually in, and common to all Plants, though ſpecified by Divers Accidents in Figure and Texture; ſo of theſe Veins, which though they be diſcernable moſtly in thoſe Plants where they hold Diſcoloured *Juices*, yet we may very probably think, that they are not wanting, where the Eye finds not that Aſſiſtance in the challenging of them. And in theſe very Plants, where they are leaſt viſible, there is yet a Time when they are, if not in all, yet in ſome parts of theſe Plants, plain enough to the naked Eye. The tender Shoots of the greater and leſſer *Maple* in *May* are full of a milky *Juice*, *viz.* the known Liquor of theſe Veins. Again, to this Purpoſe, if you apply a clean Knife Blade to a tranſverſe Cut of the like Shoots of *Elder*, the gummy Liquor of theſe Veins will be drawn forth into viſible Strings, as is the Nature of *Bird-lime*, of the Bark of *Holly*, or the Milk of *Catapucia minor Lobel.* Further, the *Leaf-ſtalks* of our *Garden-Rhubarb* do ſometimes ſhoot (by what Accident we enquire not here) a tranſparent and very pure Chryſtalline Gum, tho' the Veins that held this gummy Juice, are by no ordinary Means viſible in them, and yet by comparing the Nature and Properties of this Gum, with that of the Gums of other *Vegetables*, we cannot doubt but this *Gum Rhubarb* is the Juice of thoſe Veins, as well as we are aſſured, the Gum of other *Vegetables* to be of theirs, by the ſame *Comparative Anatomy*. Laſtly, we think, that even *Muſhrooms*, that ſeemingly inferior and imperfect Order of *Vegetables*, are not exempt and deſtitute of theſe Veins, ſome of them yielding a milky *Juice*, hot and fiery, not unlike ſome of the *Sparge*-kind, or *Euphorbium*.

The *Primary uſe* of theſe *Veins* is, in my Opinion, to carry the *Succus nutritius* of *Plants*; becauſe where they are not, there is no *Vegetation*; as it is ſeen if an *engrafted branch* or *Arm* be bared and ſtripped off the Clay, &c.

n *June*, all the Courſe of *Vegetation* will appear to have been made only by the *Bark*, and not by the *Wood*, that is, in the Place only where theſe Veins are. A Secondary uſe is the rich Furniture of our Shops: For, from theſe Veins only it is, that all our *Vegetable Drugs* are extracted, and an infinite more might be had by a diligent Inquiry, and ſome eaſy means which I have not unſucceſsfully put in Practice.

To the foregoing Obſervations I ſhall here add others of later Notice; as n.90.p.5132 the Skin of a Plant may be cut ſheer off with Part of the *Spongy Parenchyma*, and no ſigns of Milky Juice follow, that is, no breach of a Vein. Again, we have Stript the Plant of its Skin, by pulling it up by the Roots, and expoſing it to the wet Weather, until it became Flaccid as a wet thong, without any injury to the Veins, which yet upon Inciſion would freſhly *bleed*. Theſe Experiments, make againſt the general Opinion of one only Sap, looſely pervading the whole Plant, like Water in a Sponge.

In the *Tranſverſe Cuts* of *Plants*, we ſee as it were a certain Order and Number of the *bloody Orifices* of diſſected Veins.

We obſerve alſo in a Leaf, which we take to be the ſimpleſt part of a Plant,

1. That the Veins keep Company with the Ribs and Nerves (as we vulgarly call them,) and are diſtributed into all the Parts of the Leaf, according to the Subdiviſions of thoſe *Nervous Lineaments*, and are diſpoſed with them into a certain Net-work; whether by *Inoſculations* or bear *Contact* only, we pretend not to determine.

2. That in a *Tranſverſe* cut of a Leaf, the middle *Fibre*, or *Nerve*, for Example, ſeems to yield one big Drop of a Milky Juice, Springing as it were from one Vein; yet the *Microſcope* plainly ſhews us, that there are many Veins which contribute to the making up of that Drop.

3. That if a *Fibre*, or *Nerve*, be carefully taken out of the Leaf, the Veins will appear in it, like ſo many ſmall Hairs, or Pipes, Running along, and ſtriping the *Nerve*.

4. That thoſe many Veins are all of an equal bigneſs, for ought we have yet diſcerned to the contrary.

5. That though we ſeem to be more certain of the *Ramifications* of the *Fibres*, wherein theſe Veins are, yet we are not ſo, that thoſe Veins do any where grow leſs and ſmaller; though probably it may be ſo. That which makes us doubt it, is the exceeding ſmallneſs of theſe Veins already; even where we might probably expect them to be Trunk Veins, and of the largeſt ſize: And being there alſo in very great Numbers, and running in direct Lines along the *Fibre*, we gueſs that one or more of them may be diſtributed and fall off on either Hand, with the Subdiviſions of the *Fibres*, and not ſuffer any Diminution in their Bulk.

6. That we cannot diſcern any where, throughout the whole Plant larger or more Capacious Veins, than thoſe we ſee adhering to the *Fibres* of the Leaves; which do alſo appear, from Comparing the *bleeding Orifices* in a Tranſverſe cut. I have found it a difficult and laborious Task to Trace, and unravel them, throughout the whole Plant.

Our Opinion is, that theſe Veins do ſtill keep Company with their reſpective *Fibres*. And as all the *Fibres* of the Leaf are joined in the Stalk of the Leaf, and that Stalk explicated in Cloathing the Twig or Stem of the Plant, (which we take to be the Reaſon of the orderly breaking forth of the Leaves,) ſo do we think of the Veins, their perpetual Companions.

And as we have ſaid, the *Fibres* of the Leaves are joined in the Twig; ſo are thoſe of the Twigs in the Branches; thoſe of the Branches in the Trunk or Body of the *Tree*. The like alſo in an Inverted Order we ſeem to obſerve in the ſeveral *Coats* and *Ramifications* of the Root. This the ſeveral Circles of *bleeding Orifices* in Tranſverſe Cuts, ſeem to confirm.

But moreover in the Roots of Plants, if a ſimple Coat be ſeparated and expoſed betwixt your Eye and the Light, the Veins appear to be ſtrangely Entangled and implicate, and not in the ſame ſimple order as in the Leaves. The like we think of the *bark* of the *bodies* of *Trees* which we cannot diſtinguiſh from the Roots of Plants: Though there is indeed, ſomething (at leaſt at certain Seaſons of the Year) in the Root, which is not to be found in any part of the Plant beſides.

From what hath been ſaid, it may well be doubted, whether there is any *Sinus*, or common *Trunk*, into which all the Veins are gathered: But rather, that there are a Multitude of equally big Veins, each exiſting apart by it ſelf. We indeed have found it very difficult, ſo to exhauſt the Plant of its Milky Juice as to kill it, though we have given it very many Inciſions to that purpoſe. Diverſe other Inſtances there are, which favour the Diſcontinuance of the Veins, and the little Relation and Intercourſe they have with one another; as one Branch of a Tree having fair and well grown Fruit, before the other *branches* of the ſame Tree and Fruit *Bloſſom*, or have Leaves; from the different Situation and other Circumſtances of *Culture*; the Indefinite and perpetual Growth of a Tree; the *Cyon* governing, *&c.*

The ſubſtance of theſe Veins ſeems to be as truly Membranous, as the Veins of Animals. A Leaf will not give way and be extended, but the Veins in a Leaf, if freed of all the Woody *Fibres*, will be ſtretched out to one third Part at leaſt, and vigorouſly reſtore themſelves again, juſt like a Vein, Gut, or any other *Membranous Ductus* of an *Animal*. Again, theſe *Membranous Pipes* are exceeding thin and tranſparent, becauſe they ſuddenly Diſappear, and ſubſide after their being exhauſted of their Juice; and particularly, in that we ſee the Liquor, they hold, quite through them; no otherwiſe than the *blood* through our Veins; or (in *Chelidonium majus*, for Example) a *tincture* of *Saffron* in *Cryſtalline Pipes*.

In the keeneſt Froſt, which happened the other *Winter*, we Diſſected the Frozen Leaves of the Garden Spurge. Here we obſerved, that all the Juice (beſides that which theſe Veins hold) was, indeed, Frozen into perfect hard *Ice*, and to be expreſſed out in the Figure of the *Containing Pores*; but the Milky Juyce, was as Liquid as ever, but not ſo brisk as in open-Weather. This Experiment we take to be good Proof of the Perfection of this Milky Juice, and that it hath within it ſelf ſo great a degree of Fermentation that it preſerves it ſelf, and conſequently the whole Plant from the Injuries of the Weather; that is, the Plant owes its Life to it. Thus we have ſeen *Inſects* (as *Hexapode worms*, &c. lie *Frozen* upon the Snow into very Lumps of Ice, and yet put under a Glaſs, and expoſed to the Warmth of the Fire, they quickly recovered their Legs and Vigour to eſcape; which we think could not be, unleſs the *Vital Liquor* of their Veins, as in this Inſtance of Plants, had been untouched, and little concern'd in the Froſt. Further, we hence alſo urge the different Uſes as well as Natures of theſe Juices, and look upon the *Frozen Icicle*, or that Copious Dilute and Limpid Sap, as *Alimental*, the Milky and Not Frozen Juice, as the only proper *Venal*.

As to the Motion of theſe Juices, theſe things are certain:

1. That the Milky Juice always moves and ſprings briskly upon the opening of a Vein: The *Limpid Sap*, but at certain Seaſons, as it were by Accident, and not, as I judge, from any *Vital Principle*, or *Fermentation* of its own.

2. The *Venal Juice* hath a manifeſt *Inteſtine Motion*, or *Fermentation*, within it ſelf. Witneſs, beſides what hath been juſt now ſaid of it, its Contributing and the long Continuance of, that Motion to the moſt Inſenſible of Liquors; and likewiſe its thick and troubled Bleeding, like the Riſing of Yeaſt, which yet in a few Hours after drawing, falls, and the Juice becomes Tranſparent, as the Gum of the *Virginian Rhus*, &c.

We think indeed, (according to the knowledge we yet have of the *Parts* of *Plants*) that theſe Juices move by a far different Contrivance of Parts from that of *Animals*; not yet here diſcovering any uniting of Veins into one common *Trunk*, or *Pulſation*, no ſenſible ſtop by *Ligature*, no difference in Veins &c. All which difficulties, notwithſtanding, may, I hope, in time be happily overcome, and the *Analogy* betwixt *Plants* and *Animals*, be in all things elſe, as well as in the Motion of their Juice fully cleared.

There ſeem to be in *Plants* manifeſt Acts of Senſe: We inſtance in the ſudden ſhrinking of ſome *Plants*; the frequent cloſing and opening of *Flowers*; the Critical Erecting of the Heads of *Poppies* from a *Pendulous Poſture*; and particularly the *Vermicular Motion* of the *Veins* when expoſed to the Air. Again, the *Veins* of *Plants* may indeed be different, though at preſent we cannot tell wherein they are ſo; the *Arteries* within our Heads are hardly to be known by the Eye from the Veins. Further, there are natural and Spontaneous *Excretions* or venting of Superfluous Moiſture in *Plants*, viſible and conſtant, in the *Crown Imperial*, *Rorella*, *Pinguicula*, &c. As to the *Ligature*, as it hath been hitherto applied by us, it is not to be relied on for the diſcovery of this Motion; the *Veins* only of *Plants*, being the Parts probably Diſtendable.

Laſtly, We muſt either take that away from the other Reaſons given of the neceſſity of the *Circulation* of the Blood in Animals, *viz.* The hindring of its breaking and Clodding; or we muſt grant the ſame Motion to the *Venal Juice* in *Plants*. We have undeniable Experiments to ſhew, that the *Venal Juice* of *Plants* and the Blood of *Animals* agree in this, That they both, when they are once drawn from their Reſpective *Veins*, do forthwith break and Coagulate; and that the *Serum* in the one, as well as in the other, becomes a Stiff Gelly by a little ſtanding. And this Variety of Experiments hath Taught us, that probably more uſeful Preparations, and certainly a truer *Analyſis* and Separation of the Parts of *Vegetable Drugs*, may be effected, whilſt they are in Bleeding and Liquid, than after they are once become *Concrete*, and have loſt their *Natural Fermentation*.

By Dr. Wallis. n. 95. p. 6060. De Cerebro c. 15. 19. 2. The Veins of Plants, which Mr. *Liſter* obſerves not to be Ramified, but rather Bundles of them Divaricated, repreſent the *Nerves*, which (as Dr. *Willis* obſerv'd) go together in that which ſeems the common Trunk, like a bunch of Threads, which after ſeparate, and are variouſly Divaricated, and theſe *Nerves* being cut, ſhrink up as the Veins of Plants) as much, or more than do the *Veins* or *Arteries* of *Animals*.

Dr. *Willis* obſerves alſo, that there are two ſorts of *Nerves*: One ariſing from the *Cerebrum*, Subſervient to Voluntary Motions, which properly belong to the Functions of Senſe; the other from the *Cerebellum*, ſubſervient to the *Involuntary Motions*, which chiefly belong to the *Functions* of *Vegetation*. And to theſe latter ſeem Reducible thoſe Acts of Senſe, which Mr. *Liſter* ſpeaks of, in Plants.

The Nature *and* Difference *of the* Juices *of* Plants; *By Dr.* Liſter. n. 224. p. 365. LXIV. We obſerve that moſtly, *Juices* of Plants *Coagulate*, whether they be ſuch as are drawn from the Wounds of a Plant; or ſuch as do *Spontaneouſly Exſudate*: And yet even that *Exudation* ſeems to be often Accidental too, that is, by *Cancer*, or ſome other ſuch like chance.

And yet I am uncertain what to think of the ſmall *Purple Blebs* and *Veins* to be obſerved, more or leſs, on all the *Hypericum* kind, and on the *Threads* of the *Flower*, and the Hairs which cover the Leaves of *Rorella* in like manner. I doubt much, whether this may properly be call'd an *Exſudated* and *Coagulated Juice*, or no? Our Obſervations of thoſe of this Tribe, are what follow.

Purple Juice. The ſmall green Leaves, next encompaſſing the yellow Flowers of *Androſæmum Hypericoides Ger.* are ſet with very ſmall round *Blebs*, full of a *Purple Juice*; as are likewiſe, but with two or three only, the very Points or Tops of the yellow Leaves themſelves: Yet the Stalk cut, doth not to the Eye diſcover any ſuch diſtinct Veſſels, carrying that Purple Liquor, which makes me ſuſpect it is ſeparated by *Coagulation* from the reſt of the Juice, and reſerved in thoſe ſmall Bags.

Hypericum Ger. The Purple Juice yielding Blebs, in this Point are upon the Edging, on the out-ſides of all the Leaves. Alſo the Stalk, tho' round, hath a double Edge, on each ſide one; and the Blebs or Bags, tho' but thinly, are yet obſervable on theſe very riſing Edges too of the Stalks. As for the yellow Flowers themſelves, the outmoſt green Leaves, next and immediately encompaſſing them, have but a few Purple Stripes, but the yellow Leaves or Flowers, are edged with ſmall Purple Bags on the one ſide, and ſtriped with Purple Juice yielding Veins on the other. Laſtly, On the very tops of each Thread in the Flower, is one ſingle Purple Bag.

Hypericum Aſcyron dictum, Caule Quadrangulo, J. B. In like manner, all the Edges on the outſide of all the Leaves, from one end of the Stalk to the other, of this Plant, are very thick ſet with Purple-Bags. Alſo in the Flower, all the Threads have one ſingle Bag on the top ; but the Flowers or yellow Leaves, and the green ones encompaſſing them, have very few Purple ſpots or ſtreaks viſible.

Hypericum Pulchrum Tragi, J. B. Only the yellow Flower Leaves, and thoſe Green ones which next encompaſſes them, are thick edged with Purple Blebs.

Diverſe parts of the ſame Plant have diverſe Faculties, *V. C. P. A.* I add, that diverſe Parts of the ſame Plant, yield from the ſame Veins different coloured Juices: *v g.* The Milk in the Root of *Spondylium Ger.* is of a Brimſtone Colour ; but in the Stalk white.

Amongſt thoſe Juices that *Coagulate* and are Clammy, ſome there are which readily Break with a Whey.

In the middle of *July*, I drew and gathered of the Milk of *Lactuca Syl. coſta Spinoſa, C. B.* which it freely and plentifully affords. It ſprings out of the Wound thick as Cream, and Ropes, and is White ; and yet the Milk which came out of the Wounds, made towards the top of the Plant, was plainly ſtreaked or mixt with a Purple Juice, as though one had daſhed or ſprinkly Cream with a few drops of Claret. And indeed the Skin of the Plant thereabouts was Purpliſh alſo, perhaps with Veins. Again in the ſhell I drew it, it turned ſtill yellower and thicker, and by and by Curdled, that is the white and thick *Caſeous Part* did ſeparate from a thin Purple Whey. So the Blood alſo of Animals, whilſt Warm, remains Liquid and alike: But ſo ſoon as Cold it Cakes, and has a *Serum* or *Whey* ſeparated from it. Alſo the *Caſeous* part of the Milk of Animals is Glutinous and Stringy. Further, this *Serum* came freely from the other, by ſqueezing betwixt my Fingers ; and the Curds I waſhed in Spring Water, which became immediately like Rags and Tough, (draw this Milk immediately, or let it fall off the Plant, into a ſhell of fair Water, or other *Menſtruum* ; as *Vinegar*, *S. V. Spirit* of *Vitriol*, or *Sulphur*, &c.) and remained ſtill white and dry. As for the Purple Whey, after a Days Inſolation, it ſtiffned and became hard, and was eaſily formed into Cakes, which *Cakes* were yet very Brittle, and would eaſily Crumble into Powder. About *December* following, I broke one of the Cakes, made of the *Caſeous* part of the Milk of this Plant ; it then proved very Brittle and ſhined, upon breaking, like Roſin : It was then of a dark brown Colour ; moreover it burned with a laſting Flame, like Roſin or Wax ; and that being melted by heat, it would draw out into long tough Strings, like Birdlime. On the contrary, the Purpliſh Powder, which was the Whey if put into the Flame or a Candle, would ſcarce burn with a Flame at all, but ſoon be turned into a Coal. Laſtly, the Purple Powder did Taſte very bitter ; whereas the *Caſeous* part was Inſipid as Wax.

The Milk which the *Trachelium* kind plentifully yields is very thick, and preſently Curdles ; the *Serous* part, or Whey being of a brown Colour. Theſe

Juices ſmell Sowre, ſomething like the Slices of green Apples, which have been long cut.

The thin Milk of *Tithymallus Helioſcopius Ger.* Springs freely and plentifully; it is very Clammy upon the Fingers; it is very white in drawing; it turns upon a Lancet, of a dark Bluiſh: and indeed, it is both of the Colour and Conſiſtence of blue skim'd Milk; made up with Wheat Flower into Cakes, it ſhews it ſelf Greaſie or Oily, and ſcarce ever dries. It very hardly breaks or Coagulates. I kept ſome of it pure and unmixt, in little Eſſence Bottles, ſtopp'd lightly with Cork only; in theſe it broke in proceſs of time, and the Curds were eaſily to be formed into Cakes; which Cakes burned with a laſting Flame, and being melted, drew forth into Strings like Wax; the Whey was clear and like fair Water. This *broken Milk* in all my Bottles was very corrupt and ſtinking: But the *Cakes* I made up of this Juice, with *Wheat Flower*, and a little *Gum Arabick*, dryed well, and kept ſweet.

Juices *caking* and not letting go their *Whey.* Other Clammy Juices there are, which do not let go a *Whey* when they Coagulate, but *Cake* altogether.

I made *Cakes* of the Sole or unmixt Juice of *Sonchus Lævis, & Aſper*, without any Addition and it parted not with any *Whey*.

Papaver Rheas Ger. Bleeds freely a white Juice, and the Heads or *Seed-Veſſels*, when the Flower is gone, do yet bleed. I obſerved that in gathering it into Shells, it preſently turned its white Colour into a yellow, one inclining to an *Orange*. At firſt ſpringing it roaped, or was but little *Clammy*, and ſeemed to be very Liquid and Dilute; yet it did not part with any *Whey*, but grew Stiff ſoon, and is very *Reſinous* and *Oily*.

Note, The *Milks* or Juices of Plants ſeem to be compounded, and mixt of Liquors, of different and perhaps contrary Qualities: So that it is probable, if the *Caſeous* part ſhall be *Narcotick*; for Example, the *Whey* may not be ſo; or the one may be hurtful, and the other a good and uſeful Medicament.

Tragopogon flore luteo, J. B yields a Juice, which upon the firſt Springing from the *Wound*, is white and thick, but immediately it turns Yellow, and then Redder and Redder; it is of no unpleaſant Taſte, it is ſomething *Glutinous*, and very Oily, and parts not with much, if with any *Whey*, and therefore it is eaſily formed into *Cakes* alone.

Convolvulus major, J. B. bleeds freely a white Juice, as I experienced in the middle of *Auguſt*, not only the *Stalk* and *Leaves*, but the white Flowers alſo in proportion, bleed as plentifully as any part elſe. This *Milk* is very ſharp.

Saffron Coloured Juice, There is alſo a Juice of a *Saffron* Colour, which *Chelidonium majus Ger.* wounded, freely affords; this Juice breaks not with a *Whey*, but is eaſily formed into *Cakes*, and ſtiffens in the Sun, it is thick, and of the Conſiſtence of Cream, upon the ſpringing forth of it from the *Wound*.

There is another very Clammy Juice, which is of a *Golden*, or *Yellow Colour*, upon drawing; and this the *Seed Veſſels* of *Centaurium Luteum Perfoliatum C. B.* in *July*, and after, even wherein the Seed therein contained are turned *black* and *Ripe*, yield plentifully and freely enough. (Theſe Juices, which the Heads or Seed Veſſels of Plants afford, may be thought of the ſame Nature with thoſe Juices which the Pulp of Fruits afford; the *Pulps* of *Fruits*, and theſe *Exterior Veſſels* being parts Equivalent; that is, *Apples*, for Example, are nothing elſe but the *Seed Veſſels* of their *Kernels*;) It is *Liquid* upon firſt drawing, and after a while it thickens, parting with no *Whey*; (*N. B.* I call this Coagulating too) and this is of the Colour of *Amber*; it ſticks to ones Fingers, and pulls forth into Threads like *Bird-lime*; it would never become harder than very ſoft Wax, and that by being dryed in the ſhade only, for if ever ſo little expoſed to the heat of the Sun and Fire, it ſtraightway became exceeding ſoft. But as for the *Cakes* I made up of it and wheat Flour, them I found in my Cabinet in Winter very hard and firm, and the unmixt *Cakes* ſtill ſoft. Theſe burn with on unpleaſant ſmell; they Emit a laſting Flame; they ſtill keep their *Amber Colour*, and draw out in Threads, in burning like *Wax*.

To this we may add the Yellow Juice which the wounds of *Angelica Sativa Park* yield; it will not harden by Inſolation, or long keeping (for I have had an Eſſence Bottle of it by me this two Years) yet I perceive it Stiffens and will draw into Threads.

The next ſort of Coagulate and Clammy Juices, we have taken Notice of are Gums; and ſome of them ſeem long to abide *Liquid*, and perhaps *Inflamable*; others there are which grow hard, and are not to be kindled into a Flame. They are eaſily to be diſſolved in Fountain Water, (the *Gum* of *Rhubarb* and the Leaves, for Example) and do Sparkle when put into a Flame: Which two Natures Argue a *Serous* or watriſh Part in them. Again, put into a Flame, they Melt and become as it were *Liquid* and *Ductible*; which ſhews the *Caſeous* part in them. And becauſe they will not Flame, it is an Argument of their leanneſs and ſcarcity of Oil. All three put to together, plainly Evince Gums to be Coagulate Juices. Gum.

In *Auguſt* I have obſerved the Cluſters, both Green and Ripe, of *Periclymenum*, *Ger.* very Leaky; which upon nearer and heedful Inſpection I found to be a thin Clammy Juice, or Liquid Gum, which fell down upon the Leaves, and keeps its Liquid form there.

Here the Purple Juice ſeems to be a *Whey* ſeparated from the *Liquid Gum*: But, I am of Opinion, it's a Diſtinct Liquor.

Again the Red Threads of *Rorella* End, or are toped, with little Bags; which being compreſſed do yield a Purple Juice (as we above noted in the *Hypericum*), and thoſe ſmall Buttons on the very tops of thoſe Threads, are encompaſſed with ſmall Tranſparent Pearls or drops of a *Liquid Gum*. They abide in this form the hotteſt Summers Day like Dew, whence alſo the Plant has its Name; and upon the leaſt touch Cleave to your Fingers, and draw out into long Threads like Birdlime.

In like manner a *Liquid Gum* (but that it ſtands not upon ſo long Threads, and is much thicker bedewed) you may obſerve upon *Pinguicula*. *Note well*, That the ſmall Drops and Threads, or Hairs, in either of theſe two Plants, are to be ſeen upon the uppermoſt or inmoſt ſide of the Leaf; and the utmoſt and undermoſt is ſmooth or void of them; which is ſomething contrary to all other Plants I have obſerved.

Methought I obſerved about *Mid-Auguſt*, the *Chats* of the *Alder* to be *Gummy*. Perhaps it did Exſudate from the Plant it ſelf; as I gueſs the Honey-Fall, or *Gummy Dew* to be obſerved upon the Leaves of the Oak, &c. are nothing elſe.

Hard Gums.

The *Avaticum*, or *Indian Rhubarb*, ſown in our Gardens, is the only *Plant* that I have met with, or ever ſaw, which yielded a *Gum*; and yet becauſe it is of the very kind with our common *Sorrels* and *Lapathums*, I believe it not impoſſible, that even from our own Store, *Herb Gums* might ſomeways or other be had. I ſay, that off the Stalk, or indeed off the Leaves of the *Indian Rhubarb*, I have gathered an Ounce at a time in *June*, of very White and Clear, and *Hard-Gum*: In both thoſe Years I obſerved it to Flower with us, as 1670. and in that Year it did not, 1669. It exſudates from all Parts of the Stalk and *Ribs*, on (*Note well*) the underſide of the Leaf it ſelf. I gathered ſome in the form of good big Drops, others as though the Stalk had been Beſmeared with it, others ſhot into long and twiſted Wires, or Icicles. Moreover I obſerved, that the Cankered Orifices or Places where the *Gum* had burſt forth, might be followed into the *Stalk* with a Knife, and that through the *Skin*, in certain Places, I could ſee that the Juice within the *Plant* was turned Gummy, and looked clear like Ice.

Bot. Pl. Ang. App. p. 325, 334.

It is the Experiment of Mr. *Fiſher*, that the clear and defecated *Juices* of moſt *Plants*, have more or leſs Redneſs in them. Again, that the dryed Root of *Acetoſa* (a Plant of the Family with *Rhubarb*, which may well be called the *Indian Sorrel*, or *ſowre Docken*) boiled, doth dye Water with a fair red Colour. And I have obſerved, that the unripe Seeds of *Rhubarb*, yield a very fair and deep Purple, I mean the *Husk* of them. Conſider what hath been ſaid above of *Rorella*, and the *Hypericum* kind, concerning their Purple-*Juice yielding Blebs*. *Note* alſo here to this Purpoſe what we have ſet down above, that *Rhubarb*, and *Sorrel*, &c. do when they Decay turn Red.

The Juice Extracted from the Roots of our *Engliſh Rhubarb*, by a Tincture of fair *Water* ſteamed away, is nothing elſe but a lean *Uninflamable Gum*; and though it differ in Colour (perhaps from the yet *Woody* Parts in it, as being of a deep Liver Colour) from the Exſudating Gum; yet in other Natures, as this of being *Uninflamable*, *Ductible* in the Flame of a Candle, &c. it agrees with it. I may not omit, that the repeated Cuts I gave the *Stalk*, on purpoſe to have the *Gum* that way, failed my Expectation. This *Gum* is ſweet or rather of no *Taſte* at all.

To this Purpoſe Remember in Summer time to have ſeen, even the Juice of *Apples* ſpontaneouſly Gellied in *Languedoc*, and the *Apples* to look clear and hard like Ice; whence they call that ſort of *Apple Pome Gellee*, or the Frozen *Apple*: Though indeed, it be nothing elſe but the *Breaking* or *Coagulating* of the Juice in ſome Spots of it; for it is Rare to ſee one of them all over ſo.

We may here give a probable Reaſon why a gentle *Infuſion* or *Maceration* of *Rhubarb*, is a very ſure *Purge*, but the Subſtance or Powder of *Rhubarb*, or a *Decoction* thereof, will have a quite contrary Effect, and bind. We may, I ſay, think that the ſharp and tart Juice in *Rhubarb*, wherein its purging Faculty lies, is by a gentle Infuſion ſo extracted, that it turns not to *Gum* in our *Stomach*: for I cannot think that the ſowre Juice of *Rhubarb* is a ſpecifically diſtinct Liquor from the *Gum*, which I believe to be only an accidental Coagulation.

Green Plums or *Sloes*, do often break forth with a *Gum*, which is clear and tranſparent; and it ſeems to haſten, if not ripen, at leaſt the red Colour. I have cut them, to the end that I might have gathered *Gum* in the *Wounds*: which indeed I did, but yet long after, when the *Wounds* ſeem'd to be *canker'd*, and that but in a ſmall Quantity to what they voluntarily ſpend.

Lauro-ceraſus, a beautiful *Winter-Green*, which we have adopted to adorn our *Court-Walls* with, yields a clear Gum very plentifully; it is very white and very clear.

There are other ſorts of *Juices*, which will not of themſelves, that I have obſerved, exſudate out of the Wounds of their reſpective Plants.

Lime or ſtringy Juices.

I wrenched and wounded the *Holly* the latter End of *March*, and yet after ſome Days of warm and open Weather, I could not perceive the leaſt ſtirring of *Juice*: The latter End of *May* the *Bark* begins to be full of *Lime*, which you may try, by preſſing a piece of it between your Fingers, and when you would take them off, the *Juice* or *Lime* draws out into Hairs, and follows your Fingers, cleaving to them like ſmall Threads.

Bird-lime, Cat. Plant. Aug.

This *Lime* or *Juice* is ſeparated or taken out of the Bark thus; Peel off the *Bark* the *Months* of *May*, *June*, or *July*; for it then comes eaſily away, and moſt abounds with *Juice*: Boil the *Bark* in fair Water, until it be ſo tender, that the utmoſt thin grey Bark or Membrane, peel eaſily off; lay it ſo peel'd, and cover it over with green *Nettles* or *Fern*, or ſuch like. *S. S. S.* in a Cellar for about 10 Days, where it will ferment or rot, and become mouldy: Take them out, and beat them well in a Mortar to a Paſte, and roll them up into ſmall Hand-balls, and in a running Spring waſh them clean from all the woody or ſticky Parts; which is effected by pulling and teaſing them. But *Note well*, that great Care is to be taken in the waſhing of the Balls; for beſides that, they muſt, if poſſible, be forthwith Waſhed, the *Lime* will all get from you, except you ſo order the Matter, by engaging it with your Fingers that it entangle. You would imagine, that upon breaking one of the Balls, that there was little or no *Lime* in them, ſo freely they moulder and crumble. After it is once engaged throughly, it will endure waſhing, and the clearer you take away the *Woody Parts*, the better it is.

In cutting the tender Tops of *Elder*, the latter End of *May*, there will a ſtringy Juice follow your Knife, and draw out in Threads, ſomewhat like *Bird-Lime*, or the *Juice* of *Holly*: It ſeems to be in certain Veins juſt within the Circle of Teeth or Wood.

Further,

Oily Juices. Further, the diſſected Veins of many Plants afford us *Oil*, that is, ſuch a Juice which being rubbed betwixt ones *Fingers*, is not at all *clammy*, but makes them *Greaſy* and *Glib*. Some of it ſtiffens not, as far as I have yet experienced; yet I believe it to be coagulate and mixt.

We will inſtance in the *Juice* of *Helenium*, *ſive Enula Campana*, *J. B.* You may take it off with a clean Knife, whereon it looks like *Oil* mixt with Water; that is, the thin or dilute Juice of the Plant, ſpringing up out of the *Wound*, together with the *Oil*. The like Experiment may be made upon *Cicuta*. The Juice of *Angelica Sativa Park*, I found altered after a Year's Keeping, and grown very *Limy*.

Tapſus Barbatus Ger. If you ſtrip off the Leaves in *June*, it ſeems to *yield* an *Oily Juice*, but very much thinned with the *Watery* One. It ſprings freely enough; it is of a dark green Colour, and I took it in Wheat Flower, and made it up in Cakes.

Alſo the Fruits of many Plants afford *Oils*, as *Olive*, *Bacci Lauri*, *Hederæ*, *Juniperi*, *Cornus Fœmina*, &c.

The Pulp of moſt *Seeds* ſeem to abound with this *Oily Juice*, and at ſometime before their Maturity, it is liquid and viſible in them, in the Form of a Milk.

Helleborus niger Syl. Adulterinus, etiam Hyeme virens, *J. B.* The Seeds of this Plant, the latter End of *May* is very *milkey*, and by Inſolation is eaſily formed into Cakes, which are yet very *Oily*, and being long kept, I have expoſed to the Flame of a *Candle* which they received and burnt freely; ſparkling not very much, and not then neither being clammy at all. One thing I muſt not omit, that this Milk or Juice of the Seeds is of a very fiery and ſtinging Nature; for when I cut the Seeds out of the *Green Pods*, they ſtruck my *Eyes* no otherwiſe than *Onion* is wont to do Moreover, the *Tops* of my *Fingers* which were wetted with this *Juice*, did *boaken* and *ach*, as when after extream Cold one has the *Hot-Ach* in them; and that Pain continued in them for ſeveral Days, and at length the Skin of my Fingers End peel'd off.

Diacodium Album, is a Medicament of the Seeds of *Poppey*.

Rosins. There are other *Oily* Juices, which after *Coagulation* harden and are called *Roſin*; and ſuch our *Ivy* yields abundantly. Hither alſo may be referred the Juice of *Juniperus Vulgaris baccis parvis purpureis*, *J. B.* which is a hard fat Juice, and not much gummy.

In the Chops of *Ivy* made in *March*, there did exſudate a thick matter like *Barm*, *Yelcowiſh* and *Greaſy*: It melted like *Oil* betwixt my Fingers, not having the leaſt Clammineſs then perceivable. In Proceſs of time it hardened and cruſted on the Wounds like coarſe brown Sugar. It burns with a laſting Flame, and ſmells very ſtrong.

Alſo on the topmoſt Leaves of *Lactuca Syl. Coſta ſpinoſa*, *C. B.* In *July* many ſmall Drops or Pearls of an Oily Juice, Coagulated and Hardned Roſinlike, are plain to be diſcerned, eſpecially with a ſingle Microſcope: They are of an *Amber-Colour*, and Tranſparent; eaſily to be wiped off, as being

ing an Oily Juice exſudated. And I am of the Mind, that even the *Blue Flower* of *ripe Plumbs* is nothing elſe but a fine *reſinous Coagulation* of the *tranſudated Juice.*

On the underſide of the *Leaves*, and all over the *Stalk* of *bonus Henricus*, *J. B.* do ſtick infinite ſmall tranſparent *Pearls*, thoſe clear Drops are hard to the Touch, and feel like greaſy Sand ; not clammy, and therefore it was well called *Unctuoſe* by *C. B.* and we put this ſpontaneouſly exſudated *Juice*, amongſt the reſinous Coagulations.

The *Juices* of *Plants* are alſo varied and diſtinguiſhed by Fermentation. And not only the *Juices* of *Fruits* are to be *Wrought*, or ſet a *Working* ; as of the *Apple*, *Pear*, *Briar*, *Grape*, *&c.* as is well known : But there is an artificial Change, *viz.* *Malting*, to be made even in the Seeds of *Plants*, ſo as to make them ſpend freely, or let go their *Juices*, and communicate them to common Water, and receive a *Ferment*. Alſo the *Juice* of the Roots *Glycyrrhiza* will ferment. Alſo the *Juice* of the *Cane*, as *Sugar*. Again, the *tapped Juices* of *Vegetables* (wherein my obſervations are limited) are ſuſceptible of a *Ferment*. As for Inſtance ;

The 21. of *Apr.* 1665. about 8 in the Morning, I bored a Hole in the Body of a fair and large *Birch*, and put in a *Cork*, with a Quill in the middle, after a Moment or two it began to drop, but yet very ſoftly ; Some 3 Hours after I returned, and it had filled a Pint Glaſs, and then it dropped exceeding faſt, *viz.* every *Pulſe* a *Drop*. This Liquor is not unpleaſant to the Taſte, and not thick or troubled : Yet it looks as though ſome few Drops of Milk were ſpilt in a Baſon of Fountain-Water. There are many Ways of Fermenting or ſetting this Juice a Working, that is, of keeping it from *Coagulating*.

The *Maple*, both that which is miſcalled the *Sycamore*, and the *Leſſer*, *bleed* a *fermentable Juice* copiouſly, in the breaking up of hard Froſts.

Alſo the *Willow*, *Walnut*, *Poplar*, *Whicking*, are all ſaid to *bleed* in their Seaſons a *Vinous Juice*.

To *extract* the *Juice* of *Vegetables*, as *Opium*, for *Example*, (as is uſual in the beſt Preparations and Methods of making *Laudanum*) with *Spirit* of *Wine*, is not probably to ſeparate any one part of that *Coagulate Juice* from the other, as the *Serum* or *Whey*; for Example, from the *Caſeous* part of the *Juice*, but only to depurate or defecate the *Opium* ; For *S. V.* ſays Mr. *Boyle*, will diſſolve *Gum Lacc.* *Benzoin*, and the *Reſinous* Parts of *Jallap*, and even of *Guajacum*, which are *Coagulations* and mixt *Juices* ; and the ſame we may think of the *Juices* that are extracted by *S.V.* from other Herbs that are mixt.

Alſo, thoſe other Ways of roaſting and drying *Juices* upon Plates over a gentle Fire, untill they will rub to Powder, gives no great Satisfaction to me, that the *Narcoſis* of *Opium*, for Example, is gone or ſeparated, becauſe the *dryed Juice* leſs offends the Noſe ; that is, ſmells not ſo ſtrong.

The *Whey* of *Lact. Syl.* will be only diſſolv'd in cold Water, the Curds wholly refuſing to mix with it. So that ſimple Water perhaps is the beſt *Menſtruum*, and really ſeparates, what *S. V.* only depurates.

LXV. That

Herbs of the ſame Make and Claſs, for the Generality, have the like Virtue, by Mr. Ja. Petiver, n. 255 p. 289.

LXV. That Plants of the ſame *Figure* or *Likeneſs*, have for the Generality much the ſame Virtues and Uſe, will not be thought an improbable Conjecture, if we conſider that the *Organs* and *Structure* of all Plants of the ſame Family or Claſs, muſt have much the ſame Veſſels and *Ductus*'s to conſummate that regular Formation, and conſequently the *Juices* circulated and ſtrained thro' them, cannot be very *Heterogeneous*; and that as for the moſt part, the Scent and Taſte have great Affinity, ſo of Courſe their Virtue likewiſe cannot be very diſſonant.

1. As for Inſtance, the *Tribe* of *Umbelliferous Herbs*. It's the Property of theſe *Herbs* to have the Poſition of their *Flower-branches* to proceed from one *Baſis* or *Center*, which expand themſelves into an *Umbel* whoſe *Flowers* conſiſt of 5 irregular or rather unequal, (that is, differing in Shape and Bigneſs) *pentapetaloſe Leaves*, from whence their *Seed* are produced, which are Naked or Double, or by their ſplitting ſeem ſo. This Genus I generally obſerve to be endowed with a *Carminative Taſte* and *Smell*; they are powerful Expellers of Wind, and are therefore good in all *Flatulent* Diſeaſes, and of great Uſe in the *Cholick*, &c. To inſtance a few, for Example, as *Aniſe*, *Caraway*, *Cummin*, *Angelica*, *Smallage*, *Parſly*, *Lovage*, &c. The greateſt Virtue of theſe Plants lies in the Seed, and next in the Roots, and in the Leaves of ſome few.

2. The *Planta Galeata* and *Verticillata* are a *Family* of *Plants* which bear their Flowers in *Rundels* or *Whorles*, at more or leſs Diſtances round the Stalk, whoſe *Monopetaloſe Flowers*, if we may ſo call them, being ſuch at the Bottom, being *Tubuloſe*, contrary to the laſt, are generally divided into 5 unequal Segments, as the *Umbels*; but with this Diſtinction, that the two greater *Petala* or *Flower-Leaves* in this Tribe, are ſometimes above, and other times below, whereas the other are conſtantly the ſame; that is, always lie in the ſame Place, being expanded on a flat or plain Surface. The Flowers of our Verticillated Plants, from the different Poſition of their *Petala*, are therefore diſtinguiſh'd under the *Flora Galeata*, *ſeu Labiata*. The *Calyx* or the Caſe to the lower or *tubuloſe* Part of each Flower, ſerves alſo for its *Seed-Veſſel*: In the Bottom of which is contained in all I have yet obſerv'd, 4 Seeds ſet cloſe together upon a Plain, which Nature lets fall out when Ripe, the Husk being always open, and commonly divided into 5 Points, adequating the Segments of each Flower. The Sovereign Balm of theſe Herbs, chiefly conſiſts in the Leaves and Husks, rather than the Flowers. My Reaſon for giving this Preference to the *Husks* of this Tribe, before the *Flowers*, contrary to all Authors, are, becauſe I commonly obſerve the Calyces are the chiefeſt, if not the only Part, on which I find its viſcous or ſulphureous Particles to adhere; this you may very eaſily perceive, not only by its much ſtronger and penetrating Smell, but by the *Clammineſs* of this far beyond the other Parts, as is very apparent particularly in the *Husks* of *Sage*, and *Clary*. And if with *Spirit* of *Wine* you make a Diſtillation of theſe alone, you will find them much ſtronger than from a greater quantity of Flowers only; which being of finer and more volatile Parts, are only capable

of retaining what the Vicinity of the ſtronger and thicker Texture which the *Calyces* are compoſed of, and can without Prejudice eaſily communicate to them.

I look upon the Generality of this *Tribe*, to be a Degree warmer than the laſt; and their Heat conſequently to approach nearer to the *Aromata*, or *Spices*, than the *Carminatives*; and the Effects thereof to be more peculiarly appropriated to ſuch nervous Diſeaſes, as are more intenſe, and the *Umbellifera* cannot ſo quickly reach, *viz.* *Apoplexies*, *Epilepſies*, *Palſies*, &c. in which Caſes our *Lavender*, *Roſemary*, *Sage*, *Stachas*, and ſome others, are *Simples* which all our ancient Phyſicians in theſe ſtubborn Diſeaſes, have very much applauded. And we ought not to forget *Mint*, *Balm*, *Penny-royal*, *Savory*, *Thyme*, *Hyſſop*, *Marjoram*, *Baſil*, *Origanum*, *Dittany* of *Crete*, *Marum* or common *Maſtick Thyme*, with *Marum Syriacum*, and ſome other.

3. We proceed next to thoſe Herbs which have a *Tetrapetaloſe Regular Flower*; (by *Regular*, I mean, ſuch as have 4 equal *Petala* in each *Flower*.) Theſe, in Relation to their *Seed-Veſſels*, are ſubdivided under two Heads, *viz.* *Siliquoſa*, and *Capſulata*; being ſuch as have their Seeds contained in long or ſhort Receptacles, as *Pods* or *Capſules*. The moſt eſſential Virtue and Uſe of the Herbs of this Claſs, I obſerve are more particularly in the Leaves and Seed; and next them the *Roots*, and if any Parts are ſlighted, its the *Flowers* and *Pods*.

The Leaves are more particularly uſed in the *Water* and *Garden-Creſſes*, *Sea* and *Garden Scurvy-graſs*, *Hedge-muſtard*, *Iberis*, or *Sciatica Creſſes*; *Lepidium*, *Piperitis Officinarum*, *Cardamine*, *Burſa Paſtoris*, &c. To which may be added, our *Cabbage*, *Coleworts*, *Savoys*, *Sprouts*, &c. which are of this *Tribe* alſo.

Others of this *Family* that are more peculiarly eminent for the Virtue contained in their Seed, are the common *Muſtard* and *Rape*, the *Thlapſi Dioſcoridis* or *Treacle-muſtard*, the *Eruca* or *Rocket*, and *Sophia Chirurgorum*, or *Flixweed*, the Seed of which laſt, I am informed, hath for ſome Years paſt been uſed by ſeveral People in the North of *England*, for the Stone and Gravel, with very good Succeſs.

We come now to the Roots, 2 or 3 of which, have gained no ſmall Repute, as well in Diet as Phyſick, *viz.* the *Radiſhes* both Garden and *Spaniſh*, (which is the large black-rooted) as alſo the *Wild* or *Horſe-Radiſh*, and to theſe the round and long rooted *Turnep* muſt be added.

Moſt of this Tribe I find, tho' they are very hot like the 2 laſt, *viz.* the *Umbellifera* and *Verticillata*, yet they exert their Power in a much different manner, to wit, by a *Diuretick volatile Salt*; and are found moſt prevalent, and effectual in Chronick Diſeaſes; as the *Scurvy*, *Dropſy*, *Gout*, *Jaundice*, and other ill Habits of the Body, where the Blood is vitiated, rather in its Particles than irregular Motion; carrying off its Impurity, by a *Diuretick Diſcraſis*, or Diſcharge of the offending *Heterogeneous* Salts therein contained; and conſequently by Purification, diſpoſing of it to a better, or more ſane Diſpoſition.

The ſeparated Bark of a Tree reunited to the Tree, by Dr. Chr. Merret, n. 25. p. 453.

LXVI. In the Midſt of *March*, *An.* 1664. I made a Section of the Rinds of *Aſh*; and of the Tree falſly call'd *Sycamore*. The firſt Section of each of the Rinds was ſquare, whereof 3 Sides were cut, the 4*th* uncut. The Succeſs was, that the whole Bark did unite, by binding it with Pack thread, leaving a Scar in each of the ſides cut.

Then I cut off, and ſeparated entirely from the Tree, ſeveral Parts of the Bark, ſome ſhallower, leaving Part of the Bark on; others, to the very *Wood* it ſelf; both in the Trunk and Branches, from an Inch-ſquare to leſs Dimenſions, and ſome of them I bound cloſe with Pack-thred, all which were ſeparated, a new Rind ſucceeding in their Place. Some I covered over, beyond the Place of *Inciſion* with a *Diachylon Plaiſter*, and tied them faſt with Pack-thread. All which thus bound and plaiſtered, did within the Space of 3 Weeks, firmly unite to the Tree; not without ſome ſhrivelling of the outward Skin of the Bark, and alſo with ſome ſhrinking in each ſide, where the Inciſion was made, where alſo appear'd in each of the Interſtices a Scar. But tying the ſame about *Michaelmas*, and in the Winter Seaſon, at neither of theſe times any Union could be made of the Bark to the Tree; I ſuppoſe it was becauſe the Sap mounted not ſo vigorouſly, and in ſuch Plenty, as in the Spring Seaſon.

Some Branches of the forementioned Trees were decorticated round, and where no Union was, there certainly followed a *Withering* of the Branch beyond the Place, where the Section was made.

I alſo ſeparated a Twig from the Branch, by cutting of it ſloping, for the better faſtning of it to the Branch again. This *Twig* I exactly fitted to the Branch from whence 'twas cut, in the ſame Poſture it before grew in. I firmly bound it, and covered it with *Diachylon-Plaiſter*. The Succeſs was, that in 3 Days time, the *Twig* that was cut off withered.

Obſervations concerning the Barking of Trees, by S. Malpi, n. 161. p. 645.

LXVII. *Nutritii ſucci* Plantarum Motum exploraturus, in multiplicibus variiſque Arboribus Corticem Vinculo vel Circumciſione, avulſa ejuſdem Annulari Portione tentavi; & Plantæ ſuperior Portio, ultra ſcil. Sectionem perpetuo intumuit, debitumque ſortita eſt Augmentum, inferior vero nullum adepta Incrementum, ſolas interdum dedit Gemmas Hanc eandem Sectionem in humiliori *Trunci* parte, & in *Radicibus* ipſis excitavi, & perpetuo ſuperior *Trunci* vel *Radicum* pars inſigniter intumuit, & ab hac Radiculæ copioſe emanarunt, inferior vero, reliquaque Radicis Portio frequenter gracileſcendo, tandem contabuit. Quare confirmare videtur Nutritii ſucci refluus Motus ab extremis Ramis ad ultimas uſque *Radices*; unde intercepto Alimento, Compreſſione, vel Laceratione Vaſorum, remotiores Plantæ Partes, ſolito non gaudent Alimento; *Tumorque* ex relabente Succo excitatur. Propagatur autem a Foliis ipſis uſque ad Radicum extremos Apices. Quapropter Florum Cultores ſoluto in *Gyrum Cortice*, Tenellum Ramum a paterno emancipant Trunco, circum-affuſa Madida Terra, in qua erumpentes Novæ Radiculæ ſupra ſectionem vegetare incipiunt: Alimentum enim inferiora verſus propulſum, vel expreſſum, non ſolum prope Corticis Sectionem ſtagnando Tumorem excitat, ſed foras irruendo in Radiculas abſumitur; unde ſui Juris factus Surculus, Paterno tandem diſſociatur Trunco. Non raro in *Radicibus* prope *Flumina*, quarum portio obtruncata aperto gaudet Aere, ab ultimis Libri Finibus Gemmæ, Radicum Loco erumpunt, quæ in *Ramos* ſurſum attolluntur.

Experiments of the barking of *Trees* by Mr. Th. Brotherton. n. 157. p. 307.

LXVIII. 1. *Anno* 1671. A *Crab-tree*, about 4 Inches in Diameter, was hackt round with a *Hatchet*, ſo as to cut pretty deep into the Wood; beſides the cutting off of the *Bark*, for about 4 Inches Wide. After which it was the ſame Year obſerved to increaſe above the ſaid Hacking, very conſiderably, and to ſhoot in Length of Wood about one Foot. The next Year it increaſed conſiderably, and ſhot in Length about 9 Inches; but the 3d. Year it dy'd to the very Root.

Much the like was obſerved in another, part of whoſe *Bark* was eaten off by a *Canker*, that the lower Part ſtood without increaſing, and by Degrees the Wood rotted and mortified; but the upper Part increaſed to the third Year, when it dyed alſo.

Fig. 174.

A *Scots Firr* of 3 Years Growth, having a Ring of the *Bark* cut off, of the Breadth of 3 Inches, near the Bottom of the *Stem* or *Stalk*, below the uppermoſt *Knot* or *Joint*, was obſerved to grow and ſhoot out its Top about half a Yard, and the Parts all about the Ring to increaſe very much in thickneſs, much more than it would have done, if the Section had not been made. But all that Part of the Stock between the ſaid *Ring* and the *Knot* next below it, increaſed not at all; But that part which was below the next Knot increaſed ſomewhat, yet not ſo much as if the ſaid Ring of the Bark had not been cut off. The 2*d*. Year it alſo increaſed conſiderably, but not ſo much as the firſt, but the 3d. Year it dyed.

A Branch of the Tree had a Ring cut off from it, *Apr.* 1. 1686, and the Part above the Section increaſed, and grew till the 17*th* of *October* following when it was cut off from the Tree. In this ſpace of Time the Part below the Ring increaſed not at all, but ſtood at a Stay; but the Parts about the Ring ſhot out a new Joynt between a Foot and half a Yard, and increaſed in thickneſs for the whole Length of it, and in all its Parts, twice as much as it would have done if it had not been cut, as was apparent by a like Branch on the oppoſite ſide of the Knot, which was not cut nor barked round in the ſame Manner; the Bark alſo of the Part above the Section, ſwell'd or grew downwards over the woody Part, which was bare, above half an Inch in Breadth.

The uſual Time for making this Section, was either in *March*, or the Beginning of *April*.

Trial was made upon ſome young Trees, cutting a *Helical Swath*, of the Bark, about half an Inch in Breadth, by leaving a like *Helical Swath* of Bark to communicate between the upper and under Part. In this Trial, the Difference of Growth ſucceeded not, but the remaining Swath

of

of the Bark ſwelled downwards, and by the End of the Year, covered the bared Part of the Wood.

The like Event almoſt followed upon making an *Indented Section* round, of about half an Inch in Breadth; the upper *Bark* quickly ſwelling downward, and joyning again with the lower.

It was alſo obſervable, that as the upper Bark grew downwards, ſo it increaſed alſo in Thickneſs, whereas the Bark below the *Section* thickned not at all.

A *Scots Firr* of 3 Years Growth, which ſhoots forth every Year, both from the *Body* and the *Branches* a new *Joint* and circumambient Sprouts, to a determinate length, was barked with 3 *Rings*, of about 1¼ Inch broad, each about the middle of the *Internodia* or Parts of the Stock between the *Joints*. In a Year, this *Stock*, which was about the Bigneſs of a Quill, below the *Ring* to the next *Joint* continued of the ſame Bigneſs, but above the *Ring* it increaſed and grew to the bigneſs of ones Finger; and from the new *Joint* ſhot out new *Limbs* and *Stock* about a quarter of a Yard, which was ſomewhat bigger than if there had been no *Ring* made. The *Branches* increaſed likewiſe proportionably, by ſwelling in Bigneſs, and from a new *Joint* ſhooting out new Body and Limbs, at the Top or Body. And the Body of the Tree below the *Joint* to the 2*d*. Ring, increaſed more than if the *Ring* had not been made: But the Part of the Stock below the *Ring* to the next *Joint*, increaſed not at all. The like ſhooting and increaſing was obſerv'd in the 2*d*. Limbs, Joint and Stock below it, between which and the loweſt Joint it increaſed not.

On one of the *lowermoſt Branches* of a young *Scots Fir*, of 2 Years old, was made a Ring Section between the *Body* and firſt Knot of the Limb. The following Year, that Part of the Limb above the *Ring* increaſed twice or thrice as much as the correſponding Parts of the other Limbs from the ſame Knot, but the Part below the *Section* to the Body, increaſed not at all.

A young *Hazel* was cut into the Body with a deep Gaſh, and the Parts of
Fig. 175. the Body above and below, cleft upwards and downwards; and the *Splinters* a. and *b*. by *Wedges*, were kept off from touching each other, or the reſt of the Body. The following Year the *Splinter* above the *Gaſh*, was grown very much, but the *Splinter* below ſtood at a Stay, and grew not, but the reſt of the Body grew as if there had been no *Gaſh* made.

Four young *Poplar-trees*, all of *equal Bigneſs*, *Growth*, *Situation* and *Soil*, as near as could be found, were thus order'd. The firſt had all its *Branches* and *Top* cut off; the ſecond had all its *Branches* pruned off, but it was left with a ſmall Head at the Top; the third had the *Branches* cut off half-way, and thoſe of the upper half left growing; the fourth was left growing without being at all prun'd or lopp'd. In the following Years, the firſt ſhot out many *Twigs* round about, but the Body increaſed but little in Height or Bigneſs; the ſecond ſhot out likewiſe many *Twigs* where it had been pruned, and the *Top-branches* and *Top* alſo increaſed conſiderably, and the *Body* alſo increaſed much more in height and bigneſs than did the former; the third increaſed yet much more in all its Parts, than the ſecond; but the third increaſed in

Limbs, *Height*, *Bigneſs*, moſt of all; ſwelling in Bigneſs, and ſtretching in height, and ſpreading in its Boughs, much more than the third; and in about 16 Years, was more than 4 Times as big as the firſt.

In the *Great Froſt*, 1684, of 25 *Poplars* that had been pruned, 19 were killed by it, and the remaining were very weak, and hardly able to recover, and increaſed very little in the following Years. Theſe *Poplars* were about 30 *Foot* high, and had only a ſmall Head left at the *Top* unlopped, of about 4 or 5 Foot, and were prun'd the *Spring* before the *Great Froſt*. Divers alſo of thoſe which had been pruned two Summers before the Froſt, were kill'd by it; but none of thoſe which had not been prun'd at all, were hurt by it. And both in *Lancaſhire* and *Cheſhire*, Trees of 60 Foot in height, that had been pruned, and had only a ſmall *Top* left, were alſo kill'd by the ſaid *Froſt*, whereas thoſe Trees of the ſame Kind and Height, which ſtood near to 'em, but had not been pruned, continued to flouriſh, and ſuffered no Harm thereby. Several of thoſe *Branches* of about an *Inch* Diameter, and Trees, that had been barked round (as above) the Spring before the *Great Froſt*, outlived the Violence of the ſame, and the preceeding Winter.

Of the Growth of Trees, ib. p. 311.

Where theſe *Prunings* had been try'd upon Trees 20 Foot high, the Difference of their Increaſe was ſenſible the following Summer, but in 7 or 8 Years Time, the Difference is prodigious; the unprun'd Trees growing ſeveral Times bigger than the prun'd, both in Body and Branches.

When the *Top-Branches* would ſhoot out and grow 2 Foot, or more in length, the lower Branches would not ſhoot above 4 Inches, and in the Branches of the *Scotch Fir*, the Joints above the *Rings* barked round, would encreaſe and grow much bigger in 3 Years, than they would in 5 Years if the ſaid *Rings* were not cut off.

A very large *Pinaſter*, about 2 Foot and a half in Diameter, and of a Height proportionable (*viz.* of about 20 *Yards*, the loweſt Boughs of which were about 30 Foot above the Ground) did ſpread and flouriſh on every ſide alike, though it had no *Root* at all towards 3 Quarters of its Situation, but only toward one Quarter, into which it ſpread its *Roots* very far and large, Divers of them reaching about 70 or 80 Foot from the Body of the Tree: The Reaſon of which ſpreading, was occaſioned by its being planted juſt within the ſquare Angle of the Corner of a deep, thick and ſtrong ſtone Wall, which was as a kind of Banking or Wharfing againſt a River that ran by it.

Upon Conſideration of theſe, and divers other Obſervations, and Experiments, I am of Opinion, 1. That the *Sap*, (moſt of it, if not all) aſcends in the Veſſels of the lignous Part of the Tree, and not in the *Cortical Part*, nor between the *Cortical* and *Lignous* Parts. 2. That the Increaſe and Growth of a Tree in thickneſs, is by the Deſcent of the Sap, and not by the *Aſcent*. And if there were no Deſcent, a *Tree* would increaſe but very little, if at all. 3. That there is a continual Circulation of the Sap, all the Summer Seaſon, and during ſuch time as the Sap is ſtirring; and not a Deſcent at *Michaelmas* only, as ſome have held.

4. To

B. R. H. 3. p. 513. 2. To me it ſeems very Probable, that the Bodies of Plants, as well as thoſe of moving *Animals*, are nouriſh'd and increaſed by a double Food; the one an *Impregnated Water*, and the other an *Impregnated Air*, and that without a Convenient Supply of theſe two, the *Vegetable* cannot ſubſiſt, at leaſt not Increaſe. Theſe do mutually Mix and Coaleſce, and Parts of the Air convert to *Water*, and parts of *Water* convert to Air. And as ſome of this latter are rarified and freed from their Chains, and become Spiritual and Airy, ſo others of the forementioned are Clogg'd and Fetter'd and become debaſed. To this purpoſe all Plants as well as *Animals* have a two-fold kind of Roots, one that Branches and ſpreads into the Earth, and another that ſpreads and ſhoots into the Air: Both kinds of *Roots* ſerve to Receive and carry their proper Nouriſhment to the Body of the Plant, and both ſerve alſo to convey and carry off the uſeleſs Recrements; uſeleſs, I mean, any further within the Body of the Plant, though uſeful to it when they are Separated, and without it; the one for Seaſoning the Earth and Water wherein it is planted, and the other for Seaſoning and Preparing the Air.

LXIX. I had an Excellent Summer *Apple* containing abundance of very pleaſing Juice; it was of that kind, which never grows large. The Body by the burthen of the Fruit always wreathed towards the ground, the Branches were all Curl'd, and full of Knots at every turning, and theſe Branches apt to grow, if a good Knot be ſet in the Ground, as ſoon as 'tis cut off, eſpecially about *Candlemaſs*. This Tree was hollow, and very near all the *Timber* extremely Rotten, from the top of the ſtem to the Root; and every Sprig, how ſmall ſoever, appear'd Cork-colour'd and Rotten at the Heart of the *Timber*. And ſo it was generally all over the Roots; and 'tis like it had been ſo many Years before. Yet the Tree bore abundantly, with Alternative Reſts every ſecond or third Year. The Fruit had ſcarce any Core; the Kernels were very ſmall, thin, and empty; nevertheleſs the Branches from the Knots, grew well enough to Repleniſh a Nurſery for me. This ſeems to Intimate, the Correſpondence between the Pithy Part, Heart or *Timber*, and the *Seeds*. And more to confirm this; a young Tree grew like a Sucker from the only ſound Root of the aforeſaid Apple-Tree. This Tree grew Straiter than others of the ſame kind uſually do; of which I conceive the cauſe to be this: Suckers are commonly Barren a pretty long time; and this continued Barren till the ſtem was ſtrong enough to bear the Fruit which loaded the Branches. But that which makes to our Purpoſe, is this: All the Fruit of this young Tree, had full and ſound Kernels; and though it was the ſame Fruit, growing from the Root of the ſame Tree, yet it ſeem'd not altogether ſo Tender, Delicious, and Juicy, as the Fruit of the old Tree; nor yet was the Tree ſo Fruitful. The *Sap* in the old Tree was leſs diverted, it ſeems, to ſuſtain the Life of the *Timber*, which was now conſum'd, and thereby, was wholly appropriated for the Leaf, Bloſſom, and the Pulp of the Fruit. For I do not undertake, that the *Sap* yields no Relief to ſuſtain the Life and Growth of the *Timber* ordinarily, and whilſt the *Timber* is Entire: But I rather conceive, that there is a more immediate and Peculiar Relation, between the *Sap* and Pulpous Fruit; and the like between the

The Communication of the Parts of the Tree with the Parts of the Fruit; By Dr. J. Beal. n. 45. p 860. n 46. p. 919. *Vid. Sup.* §. LX. 6.

Timber or whole Stock, and the Root of the Tree, to tranſmit the ſame *Spirit* and *Nature* to the *Seed*, of what kind ſoever it be.

Some are of Opinion, that there paſſes into the *Timber* no part of meer Earth to ſuſtain the Life and Growth of the Plant, but it only feeds on the Succulent Part, Aſcending by the Roots, and on the Air, and the Moiſture which the Dews of Heaven, the Rainy Seaſons, and the Air afford. And if we conſider, that ſome lofty Trees grow upon the *Rocks*, where little or no Earth can be found; as alſo, how largely the *Oak* and *Pear-Tree* grows and ſpreads; and how many Years the one bears Acorns, the other *Pears*; ſometimes to the Quantity of yielding 5 or 6 Hogſheads yearly (as I have known them do,) and in Compariſon, how little *Maſs* of Earth about the Roots appears; we may find more Cauſe to Attribute this large Expence of Materials to the Perpetual ſupply of Moiſture, than of much Earth. I will give you an Experiment, which may ſeem to determine the Point, though I yet ſuſpend my Judgment.

I took the largeſt of *Kentiſh Codlins*, *Pearmains*, *Repins*, and *Deuſans*, I Withered them (which may be ſoon done many ways,) and then I cut them in the middle, quite through the midſt of the *Kernels*, having carried them ſome Days in my Pocket, all that ſaw them took them to be very Wood, and they were indeed like very cloſe Cork. And ſome Philoſophical Perſons (though I affirmed no Falſhood, but conceal'd the whole Matter,) did upon the View, ſpread it abroad, that I had the Art of Converting all Fruit into *Wood*, Pulp and *Kernels* and all was *Wood*. The ſame may be done upon *Pears*, *Cucumbers*, *Turneps*, and all the *Grains* and *Vegetable Seeds*, that are ſtuck in them, and are cheriſhed by a ſupply of *Marly Water*; thus I have had the Blades of *Wheat* and the *Halms* of *Peaſe* grow out of them to the length of a Foot; and then, by hanging it in a Cloſet, all becomes turned into *Wood* and in ſome time after, all is turned in Duſt and Earth. And as we are well taught by Mr. *Boyle*, that pure *Liquids* may be converted into Earth; ſo theſe *Terreſtrial* Parts of the Fruit may be, from the *Liquors* thither Collected, and derived from the Maſs of the Earth.

But to return to the clearing of the *Affinities* above claimed, I inſtance in *Barberry Roots*, Perforated by me, which bore *Berries* that had no Stones at all; And in hollow'd *Apple-Trees* the *Kernels* will be very thin, and empty Skins, and uncapable of Growth. Gardeners tell me, that if you take the hard Stick out of the Root of *Parſly*, it will bear no kind of *Seed*. But it may be Objected, that a very Hollow *Oak* and an Hollow *Elm* to bear *Pregnant Seed*. I Anſwer, that an *Elm* is all Tember to the Bark; and an *Oak*, when 'tis all *Putrid* at the Heart, yet may have firm *Wood* enough to Convey the Spirit of the Root into the *Acorn*, and the Roots may be ſound, when the Body of the Tree is much decayed by Rain beating in at the lop'd *Tops*, or by other Paſſages through the Bark. We ſee that *Beans*, *Wheat*, and other Grains, grow kindly, if the Eye and Parts next adjoining be whole though the *Beans* be full of great Holes in other Parts, or the main Body of the *Wheat* be cut off with Sciſſors. However, let the Objection give us the more Caution, that if we deſign to have Fruit without Stones, the Perforation be the bolder and the more Compleat.

And to proceed further, ſome Trees are leſs Fruitful, or altogether Barren by the Exceſſive Growth and Firmneſs of the *Timber*: And theſe are recover'd by croſs deep Hackings through the Bark; and ſuch injuries done to the *Timber*, both in the Stem and Main Roots; and they cleave the Roots, and put a Stone in the Cleft, that it may not Cloſe again too haſtily. If this Violence be not done both to the *Stem* and *Roots*, the Remedy may fail. We ſee alſo, that Vines are leſs Fruitful, when they are Permitted to Run out into many Woody Branches.

To ſhew alſo the *Proximity* between the Sap of the *Bark*, and the Pulp of the Fruit, I did in the Summer time make Reſts for Water on the Body of the *Kentiſh Codlin-Trees*, and cauſed Water to be frequently poured into thoſe Cavities. The Effect was this, the *Apples* grew to an Extraordinary Bigneſs, and were very Inſipid; and many of them had parts in appearance much like the *Pulp* of *Limons*. Some I ſuffered to hang on the Tree as long as they would, and thoſe became full of Spots of the Colour of *Cork*, or like the Rottenneſs of an *Apple*.

I Omit the reſt, and haſten to Redouble a Remark of the great uſe which may be made of the chiefeſt Experiment. The Graft carries the Maſtery from the *Stock* for the Pulp of the Fruit; ſo that we have little hope of much change by meer Graftings, how oft-ſoever iterated. But if after many, and ſtrange, and choice Engraftings, you ſet the *Kernel*, *Stone*, or *Seed*, of the Grafted Fruit in a kind Mould, you may then expect ſome New or Mingled kind of Plant, as *Semi-Apricocks*, *&c.* And thus the *Almond* and *Peach* may by many Changes in the Graftings, and by *Inteneration* of the Stones of the *Peaches*; and of the Shells of the *Almonds*, and by *Terebrations* of the *Stem* and *Root*, here and there, alter their Guiſes ſo that the Coat of the *Almond* may approach to the *Pulp* of the *Peach*; and the *Kernel* of a *Peach* be enlarged to a kind of *Almond*. And great ſtore of better Contrivances may from hence take riſe.

* Obſervations *concerning Vegetation*; *By Dr.* J. Beal. n. 56. p. 1131.

LXX. It is very difficult to determine whether Salt or Water be the nearer and more Original Principle of all mixt Bodies; or the more Copious, more Active, or more Influencing, in this or that Body. But this we have before our Eyes, that, *Birch* and *Alder* feed more kindly on a thin Uliginous Moiſture; the *Elme*, *Pine*, *Firr*, *Pitch*, and *Cypreſs*, chuſe a Stronger Liquor: Yet theſe and many more of the wideſt Difference, are ſometimes ſeen to draw their whole Suſtenance, Bulk, and Ornaments whether Annual or Perennial, from the Liquors they find in the ſame piece of Ground, and from the *Ambient Air*, and *Dews*; when as yet by our beſt diligence we cannot Diſtinguiſh the Liquors or Salts cloſely approaching their ſeveral *Roots*. And we may Change all the Earth totally from the Roots of Trees, whoſe *Barks*, *Sap*, *Fruit* and *Seed* have very much differing Salts, and are of very different kinds; and yet ſee each Tree proſper the better by the *Exchange*. Hence we may ſuſpect, that the very *Contextures* of their Bodies, from the firſt Spirting of the *Seed* and as they are formed gradually from the Inviſible Principles or Spirit and Vigour of their Seeds, however ſmall and imperceptible, are the *Natural Limbecks*, where the common Rain-Water and Air, are

Digeſted into very much Differing Leaves, Fruit, Seed, Reſins, Gums, Cooling Juleps, *&c.* perhaps as the Cow's Belly Converts the common Juice of all ſorts of Graſs into Milk; or as the Bee ferments the Dew of all Flowers into *Honey* and *Wax*.

We ſee alſo, that an Handful of *Moſs*, ſometimes above a Span long, and reſembling *Vegetables*, grows out of a ſmall *Oyſter-ſhell*, without Earth, Dirt or Sand, for the relief of the Root, Trees out of bare Rocks, and the Annual *Attire* of *Harts* and *Bucks*, out of their *Bony-Heads*. Whence we may eaſily apprehend, how the *Seeds* in their time, and afterwards the *Roots*, *Stems*, and *Leaves* of *Trees*, may be the proper *Strainers* to generate the *Peculiar Saps* and *Juices*; and perhaps to Ferment and Boyl the *Liquors* into their ſeveral Salts. It may paſs for a Reſemblance, if not for an Inſtance, that the *Juice* of ſome ſweet *Pears* may be dryed into a very ſweet *Sugar*; and the *Juice* of ſome other *Pears* is ſo fierce, that at the very opening of the *Rind* with the Teeth, it doth almoſt Suffocate, as if it would Kill dead immediately; and yet this *Juice* by time and ſeaſonable Maturation becomes Sweet, Winy and *Luſcious*. And we hear of diverſe *Exotick Fruits* that will Kill outright, and that ſo quick as may Challenge the Fierceſt *Menſtruum* of an Expert *Chymiſt*. Now as the Horns of a *Stag* have their whole Growth and Virtue from the protruding Blood and Spirits of the *Animal*, the *Moſs* (as by the *Microſcope* appears when Withered) from the Inward Shell of the *Oyſter* and the *Marine Water*: So in *Plants*, the Sap may by Heaters and Coolers, and other Changes in Summer, Autumn, and Winter, by Winds, and Compreſſing *Air*, be hardned into Timber, Seeds, and their Stones and Kernels. All ſeems to be but Sap at the firſt Draught, or little elſe beſides pure Air and Water, till theſe be concreted into Peculiar Salts by more curious Strainers, and by more Subtile Boylers than Art hath hitherto deviſed. And this was my Aim in a Former Paper, where by a ſlight and Curſory Alluſion, I compared the Motion of Sap in *Vegetables* to the *Deſcent* of *Liquors* in an *Alembick*: I had no thought of ſquaring the Compariſon to agree in all Circumſtances. Neither had I any Phanſy, that the Sap in Winter Deſcended to the Root, ſince I ſaw an *Apple Tree*, that yielded 4 or 5 Hogſheads of ſtrong *Cyder* Yearly, and a *Pear-Tree* that yielded more *Perry*; yet both growing on a dry Ground, where they could get no other Liquor than what the Clouds and the Air fforded. Yet I conceive, that theſe Trees have an intercourſe of Peculiar ſpirits ſome way linked together, and vigorouſly Cooperating, from the very ibres of the loweſt Roots to the Top Leaves.

Vid. Sup. §. LX. 1.

LXXI. The Ancients generally intituled the Earth to the Production of e *Animals*, *Vegetables* and other Bodies upon and about it: But ſeveral of e Moderns, and ſome of very great Name too, both here and abroad, ve given their Votes in behalf of Water. My Lord *Bacon* is of Opinion, at *for Nouriſhment of Vegetables the Water is almoſt all in all, and that the* rth *doth but keep the Plant upright, and ſave it from Over-heat and Over-* d. Others there are who are ſtill more Expreſs; and Aſſert Water to the only Principles or Ingredient of all Natural Things. They Sup-

Some Thoughts and Experiments concerning Vegetation, By Dr. J. Woodward. n. 253. p. 193.

poſe, that, by I cannot tell what Proceſs of Nature, Water is Tranſmuted into Stones, into Plants, and, in brief, all other ſubſtances whatever. *Helmont* particularly, and his Followers, are very Poſitive in this; and offer ſome Experiments to render it Credible; and Mr. *Boyle* diſcovers a great *Propenſity* to the ſame Thoughts and Opinion they had.

The Experiments they inſiſt upon are chiefly two; the firſt is, that *Mint* and ſeveral other Plants proſper and thrive very greatly in Water. The other is this; they take a certain quantity of Earth, and Bake it in an Oven; then they Weigh it, and put it into an Earthen Pot; having well water'd this Earth, they make choice of ſome fit Plant, which being firſt carefully weighed, they ſet in it. There they let it grow, continuing to Water it for ſome time, till 'tis much advanced in bigneſs. Then they take it up, and tho' the bulk and weight of the Plant be much greater than when firſt ſet, yet upon baking the Earth, and weighing it, as at firſt, they find it little or not at all diminiſhed in Weight, and therefore conclude, 'tis not the Earth, but Water that Nouriſhes, and 'tis turned into the Subſtance of the Plant.

I muſt confeſs, I cannot ſee how this Experiment can ever be made with the Nicety and Juſtneſs that is Requiſite. However nothing like what theſe Gentlemen would infer, can poſſibly be concluded from it; unleſs Water, which they ſo plentifully beſtow upon the Plant, in this Experiment, be Pure, Homogeneous, and not Charged with any *Terreſtrial Mixture*; for if it be, the Plant after all, may owe its Growth and Encreaſe intirely to that.

Some Waters are indeed ſo very Clear and *Tranſparent*, that one would not eaſily ſuſpect any *Terreſtrial Matter* were latent in them: Yet that is far ſhort of a Proof, that in Reality there is none. For they may be highly Saturated with ſuch matter, tho' the Eye be not preſently able to deſcry or diſcern it. If Pure and abſolutely Refined Silver be perfectly diſſolved in Spirit of *Nitre*, or *Aquafortis*, that is Rectified and thoroughly Fine, it doth not darken the *Menſtruum*, or render it leſs Pellucid than before.

But, after all, I never met with any Water, that however freſh, and newly taken out of the Spring, did not exhibit, even to the *Naked Eye*, great Numbers of exceeding ſmall *Terreſtrial Particles*; diſſeminated through all Parts of it. *Thicker* and *Craſſer Water* exhibits them ſtill in greater Plenty.

Theſe are of two general kinds. The one a *Vegetable Terreſtrial Matter*, conſiſting of very different *Corpuſcles*, ſome whereof are proper for the *Formation* and *Increment* of one ſort of Plant, and ſome of another, as alſo ſome for the Nouriſhment of one Part of the ſame Plant, and ſome another. The other kind of Particles ſuſtain'd in Water, are of a Mineral Nature. In ſome Springs we find common Salt, in others *Vitriol*, in others *Alum*, *Nitre*, *Sparr*, *Ochre*, &c. Nay frequently ſeveral of theſe, or other *Minerals* all in the ſame Spring. All Water whatever is much charged with the *Vegetable Matter*, this being fine, light, and eaſily Moveable. As for the Mineral, the Water of Springs contains more of it, than that of Rivers

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eſpecially when at a diſtance from their *Sources*: and that of Rivers, more than the Water that falls in Rain.

If any one (who deſires further Satisfaction herein) put *Water* into a clear Glaſs Vial, ſtoping it cloſe, to keep Duſt, and other Exterior Matter out, and letting it ſtand without ſtirring it, for ſome Days; he'll then find a Conſiderable Quantity of *Terreſtrial Matter* in the Water, however Pure and free it might appear when firſt put into the Vial, He'll in a very ſhort time obſerve, as I have frequently done, the *Corpuſcles*, that were at firſt, while the Water was Agitated and kept in Motion, ſeparate and hardly *Viſible*, by Degrees as the Water permits by its becoming more ſtill and at reſt, Aſſembling and Combining together; By that means forming ſomewhat larger and more Conſpicuous *Molecula*. Afterwards he may behold theſe Joining, and fixing each to other; by that means forming large thin *Maſſes*, appearing like *Nubecula*, or Clouds in the Water, which grow more thick and Opaque, by the Continual Appulſe and Accretion of freſh Matter: If the ſaid Matter be chiefly of the *Vegetable Kind*, 'twill be ſuſtained in the Water, and diſcover at length a Green Colour, becoming ſtill more of that Colour; I mean an higher and more Saturate *Green*, as the Matter thickens and encreaſes. But if there be any Conſiderable Quantity of meer *Mineral Matter* in the Water, this being of a greater *Specifick Gravity* than the *Vegetable*, as the Particles of it Unite and Combine in ſuch Number, till they form a *Molecula*, the *Impetus* of whoſe *Gravity* Surpaſſes that of the Reſiſtance of the Water, Subſides a great deal of it, to the bottom. Nor does it only fall down it ſelf, but frequently Intangling with the *Vegetable Nubecula*, forces them down along with it.

Upon the whole, 'tis Palpable and beyond reaſonable Conteſt, that Water contains in it a very conſiderable *Quantity* of *Terreſtrial Matter*.

Now the Queſtion is, to which of theſe, the Water or the Earthy Matter ſuſtained in it, *Vegetables* owe their Growth and Augment.

For Deciding of which, I conceive the following Experiments may afford ſome Light: And I can ſafely ſay, they were made with due Care and Exactneſs.

An. 1691. I choſe ſeveral Glaſs Vials, that were all, as near as poſſible, of the ſame ſhape and bigneſs. After I had put what Water I thought fit into every one of them, and taken an Account of the Weight of it, I ſtrained and tyed over the Orifice of each Vial, a Piece of Parchment, having an Hole in the Middle of it, large enough to admit the Stem of the Plant I deſigned to ſet in the Vial; without the Confining or Straightning it ſo, as to Impede its Growth. My Intention in this, was to prevent the encloſed *Water* from Evaporating or Aſcending by any other way than only thorough the Plant that is to be ſet therein. Then I made choice of ſeveral Spriggs of Mint, and other Plants, that were, as near as I could poſſibly Judge, alike Freſh, Sound, and Lively. Having taken the *Weight* of each, I placed it in a Vial, ordered as above; and as the Plant imbibed, and drew off the *Water*, I took care to add more of the ſame from time to time; keeping an Account of the *Weight* of all I added. Each of the Glaſſes were, for better Diſtinction, and the more Eaſy keeping a Regiſter of all Circumſtances, Noted with a different Mark or Letter, *A, B, C, &c.* and all ſet in a row, in the ſame Window, in ſuch manner that all might partake alike of Air, Light, and Sun. Thus they continued from *July 20th* to *October 5th.* which was juſt 77 Days. Then I took them out, weighed the *Water* in each Vial, and the Plant likewiſe, adding to its *Weight* that of all the Leaves that had fallen off, during the time that it ſtood thus. And laſtly, I Computed how much each Plant had gained; and how much Water was ſpent upon it. The Particulars are as follows.

Diſtinction of the Glaſſes.	*The ſeveral Sorts of Plants and Water.*	*Weight of the Plant* when put in	when taken out.	*Weight Gained in 77 Days.*	*Expence of Water*	*The proportion of the Encreaſe of the Plant to the Expence of W.*
A.	Common *Spear-Mint* ſet in *Spring Water.*	gr. 27	gr 42	gr. 15	gr. 2558	1, to 170 8/15
B.	Common *Spear-Mint*, in *Rain Water.*	28¼	45¾	17½	3004	1, to 171 23/35
C.	Common *Spear-Mint*, in *Thames-Water.*	28	54	26	2493	1, to 95 23/26.
D.	Common *Solanum*, or *Night Shade*, in *Spring Water.*	49	106	57	3708	1, to 65 3/57.
E.	*Lathyris, ſeu Cataputia Gerh.* in *Spring Water.*	98	101½	3½	2501	1, to 714 4/7.

The Common *Solanum* in the Vial *D.* had ſeveral Buds upon it when firſt ſet in the *Water*: Theſe in ſome Days, became fair Flowers, which were at length ſucceeded by Berries.

Two other Vials *F.* and *G.* were filled, the former with Rain, the other with *Spring-Water*, at the ſame time as thoſe above mentioned were; and ſtood as long as they did. But they had neither of them any Plant; my Deſign in theſe being only to inform my ſelf, whether any *Water Exhaled* out of the *Glaſſes*, otherwiſe than thorow the *Bodies* of the *Plants*, The *Orifices* of theſe two Glaſſes were covered with *Parchment*, each Piece of it being *perforated* with an *Hole* of the ſame *Bigneſs* with thoſe of the *Vials* above. In this I ſuſpended a bit of *Stick*, about the *Thickneſs* of the *Stem* of one of the aforeſaid *Plants*, but not reaching down to the ſurface of the included *Water*, I put them in thus, that the *Water* in thoſe might not have more Scope to evaporate than that in the other Vials. Thus they ſtood the whole 77 days, in the ſame *Window* with the reſt; when upon Examination, I found none of the Water in theſe, waſted or gone off; tho' I obſerv'd, both in theſe, and the reſt, eſpecially after hot Weather, ſmall Drops of *Water*, not unlike *Dew*, adhering to the Inſides of the Glaſſes, that part of them I mean, that was above the *Surface* of the encloſed *Water*.

The *Water* in theſe 2 Glaſſes, that had no *Plants* in them, at the End of the Experiment, exhibited a larger *Quantity* of *terreſtrial Matter*, than that in any of thoſe that had the *Plants* in them did; the Sediment at the bottom of the *Vials* was *greater*, and the *Nubecula* diffuſed thro' the Body of the *Water thicker*. And of that which was in the others, ſome of it proceeded from certain ſmall *Leaves* that had fallen from that part of the *Stems* of the *Plants* that was within the *Water*, wherein they rotted and diſſolved.

The *Terreſtrial Matter* in the *Rain Water*, was finer than that in the *Spring Water*.

An 1692. I repeated the Experiment; the Plants were all *Spear Mint*, the moſt kindly, freſh, ſprightly Shoots I could chuſe. The *Vials* were ſet in a Line in a *South Window*, where they ſtood from *Jun.* 2. to *Jul.* 28. which was juſt 56 *Days*.

Diſtinction of the Vials.	*The ſeveral ſorts of Water.*	*Wt. of when put in.*	*Plant when taken out.*	*weight gained in 56 Days.*	*Expence of Water.*	*Proportion of the Growth of the plant to the Expence of Water.*
		gr.	*gr.*	*gr.*	*gr.*	
H	*Hyde-park Conduit Water.*	127	225	128	14190	1, to 110 $\frac{110}{128}$
I.	*Hyde-park Conduit Water.*	110	249	139	13140	1, to 94 $\frac{74}{139}$
K.	*Hyde-park Conduit Water, in which was diſſolv'd an Ounce and an half of common Garden Earth.*	76	244	168	10731	1, to 63 $\frac{147}{768}$
L.	*Hyde-park Water, with the ſame Quantity of Garden Mould as in the former.*	92	376	284	14950	1, to 52 $\frac{182}{284}$
M.	*Hyde-park Water diſtill'd off with a gentle Still.*	114	155	41	8803	1, to 214 $\frac{29}{41}$
N.	*Reſidue of the Water which remained in the Still after that in* M *was diſtill'd off.*	81	175	94	4344	1, to 46$\frac{1}{5}$ $\frac{1}{4}$

The Plant which was ſet in *H.* was all along a very kindly Plant; and had run up to above a Foot in Height. It had ſhot but one conſiderable *Collateral Branch*, but had ſent forth many and long Roots, from which ſprung very numerous, though ſmall and ſhort leſſer *Fibres*. Theſe leſſer Roots came out of the larger, on two oppoſite Sides, for the moſt part; ſo that each Root, with its *Fibrillæ*, appeared not unlike a ſmall Feather; to theſe *Fibrillæ* adhered pretty much terreſtrial Matter. In the *Water*, which was at laſt thick and turbid, was a green Subſtance, reſembling a fine thin *Conferva*.

The Plant in *I.* was as kindly as the former, but had ſhot no *Collateral Branches*. Its *Roots*, the *Water*, and the *Green ſubſtance*, all much as in the former.

The Plant in *K.* tho' it had the Misfortune to be annoyed with many ſmall *Inſects* that happened to fix upon it, yet had ſhot very conſiderable *Collateral Branches*; and at leaſt as many Roots, as either that in *H.* or *I.* which had a much greater Quantity of *Terreſtrial Matter*, adhering to the Extremities of them; the ſame green Subſtance here that was in the two preceeding.

The Plant in *L.* was far more flouriſhing than any of the Precedent, had ſeveral very conſiderable *Collateral Branches*, and very numerous Roots; to which *Terreſtrial Matter* adhered very copiouſly; the Earth in both theſe Glaſſes, *K.* and *L.* was very ſenſibly and conſiderably waſted, and leſs than when firſt put in; the ſame ſort of green Subſtance here, as in thoſe above.

The Plant in *M.* was pretty kindly, and had two ſmall *Collateral Branches*, and ſeveral Roots, tho' not ſo many as that in *H.* or *I.* but as much *Terreſtrial Matter* adhering to them as thoſe had; the Water was pretty thick, having very numerous ſmall *Terreſtrial Particles* ſwimming in it, and ſome Sediment at the bottom of the Glaſs. This Glaſs had none of the green Matter above mentioned in it.

The Water in *N.* was very turbid, and as high-coloured (reddiſh) as Ordinary Beer; the Plant in it was very lively, and had ſent out 6 *Collateral Branches*, and ſeveral Roots.

O. Hyde-park Conduit Water, in which was Diſſolved a Drachm of *Nitre*.

The *Mint* ſet in this, ſuddenly began to wither and decay; and dyed in a few Days. As likewiſe did two more Sprigs, that were ſet in it, ſucceſſively. In another Glaſs, I diſſolved an Ounce of good Garden Mould, and a Dram of *Nitre*, and in a third, half an Ounce of Wood Aſhes, and a Dram of *Nitre*, but the Plants in theſe ſucceeded no better than in the former.

P. Hyde-park Conduit Water. In this I fixed a Glaſs *Tube*, about 10 Inches long, the Bore about $\frac{1}{6}$ of an Inch in Diameter, fill'd with very fine and white Sand, which I kept from falling down out of the *Tube* into the *Vial*, by tying a thin piece of Silk, over that End of the *Tube* that was downwards. Upon Immerſion of the lower End of it into the Water, this by little and little *Aſcended* quite to the upper Orifice of the *Tube*. And yet in all the 56 Days which it ſtood thus, a very inconſiderable Quantity of *Water* had gone off, *viz.* ſcarcely 20 Grains, tho' the *Sand* continued moiſt up to the top till the very laſt. The *Water* had imparted a green *Tincture* to the *Sand*, quite to the very top of the *Tube*, and in the *Vial* it had precipitated a greeniſh Sediment mixt with black; to the bottom and ſides of the *Tube*, as far as 'twas immerſed in the *Water*, adhered pretty much of the green Subſtance deſcribed above.

Q. R. S. &c. Several *Plants* ſet in *Vials*, ordered in like manner as thoſe above, in *Oct.* and the following colder Months; theſe throve not near ſo much, nor did the *Water* aſcend in nigh the Quantity it did in the hotter ſeaſons, in which the before recited *Trials* were made.

1. *In Plants of the ſame Kind, the leſs they are in Bulk, the ſmaller the Quantity of the Fluid Maſs in which they are ſet, is Drawn off; the Diſpendium of it, where the Maſs is of equal Thickneſs, being pretty nearly proportioned to the Bulk of the* Plant. Thus that in the Glaſs, Marked *A*, which weighed only 27 *Gr.* drew off but 2558 Grains of the *Fluid*: And that in *B*, which weighed only 28¼, took up but 3004 Gr. whereas that in *H*, which weighed 127 *Gr.* ſpent 14190 *Gr.* of the Liquid Maſs.

Some Reflections on the foregoing Experiments Ib. p: 207.

The *Water* ſeems to aſcend up the *Veſſels* of *Plants* in much the ſame manner as up a *Filtre*; and 'tis no great Wonder that a large *Filtre* ſhould draw off more Water than a leſſer; or that a Plant that has more and larger Veſſels ſhould take up a greater Share of the Fluid in which 'tis ſet, than one that has fewer and ſmaller ones can.

2. *The much Greateſt part of the fluid Maſs that is thus drawn off, and Conveyed into* Plants, *does not ſettle or abide there; but paſſes through the Pores of them, and exhales up into the Atmoſphere.* That the Water in theſe Experiments aſcended only through the Veſſels of the Plants is certain. The Glaſſes *F.* and *G.* that had no Plants in them, tho' diſpoſed of in like Manner as the reſt, remain'd, at the End of the Experiment, as at Firſt, and none of the Water was gone off; and that the greateſt Part of it flies off from the Plant into the *Atmoſphere*, is as certain. The leaſt Proportion of Water expended was to the Augment of the Plant, as 46. or 50. o 1. And in ſome the Weight of the Water drawn off, was 100, 200, nay, in *One* above 700 times as much as the Plant had received of Addiion.

This ſo continual an *Emiſſion* and Detachment of Water, in ſo great Plenty from the parts of Plants, affords us a manifeſt Reaſon why Countries hat bound with *Trees* and the larger *Vegetables* eſpecially, ſhould be very bnoxious to *Damps*, great *Humidity* in the Air, and more frequent Rains, han others, that are more open and free. The great *Moiſture* in the Air, was a mighty Inconvenience and Annoyance to thoſe who firſt ſettled in *America*; which at that time was much overgrown with Woods and Groves; ut as theſe were burnt and deſtroyed, to make way for Habitation and

Culture of the Earth, the Air mended, and clear'd up apace, changing into a Temper much more dry and ſerene than before.

Nor does this *Humidity* go off pure and alone, but uſually bears forth with it many Parts of the ſame Nature, with thoſe whereof the Plant, through which it paſſes, conſiſts. The *Craſſer* indeed are not ſo eaſily born up into the *Atmoſphere*, but are uſually depoſited on the ſurface of the *Flowers*, *Leaves*, and other parts of the Plants: Hence comes our *Manna*s, our *Honies*, and other gummous Exudations of *Vegetables*. But the finer and lighter Parts are with greater Eaſe ſent up into the *Atmoſphere*; thence they are convey'd to our *Organs* of *Smell*, by the Air we draw in Reſpiration; and are pleaſant or offenſive, beneficent or injurious to us, according to the Nature of the Plants from whence they ariſe. And ſince theſe owe their Riſe to the Water that aſcends out of the Earth, thro' the Bodies of Plants, we cannot be far to ſeek for the Cauſe why they are more numerous in the Air, and we find a greater Quantity of Odours exhaling from *Vegetables*, in warm, humid Seaſons, than in any others whatever.

3. *A great part of the Terreſtrial Matter that is mixt with the Water, Aſcends up into the* Plants *as well as the Water.* There was much more *Terreſtrial Matter* at the End of the Experiment, in the *Water* of the *Glaſſes F*, and *G.* that had no Plants in them, than in thoſe that had Plants. The *Garden-mould* diſſolved in the *Glaſſes*, *K.* and *L.* was conſiderably diminiſhed, and carried off. Nay, the terreſtrial and vegetable Matter was born up in the *Tubes* filled with *Sand*, *Cotton*, &c. in that Quantity as to be evident even to ſenſe.

If I may be permitted to look abroad a while, towards our Shores and Parts within the Verge of the *Sea*, theſe will preſent us with a large Scene of Plants, that along with the *Vegetables*, take up into them meer *mineral Matter* alſo, in a great Abundance. Such are our *Sea-purſlains*, the ſeveral ſorts of *Alga's*, of *Sampires*, and other Marine Plants. Theſe contain common *Sea Salt*, which is all one with the *Foſſile*, in ſuch Plenty, as not only to be plainly diſtinguiſh'd on the *palate*, but may be drawn forth of them in conſiderable Quantity.

How apt, and how much diſpoſed this *Vegetable Matter*, being ſo very fine and light, is to attend *Water* in all its Motions, and follow it into each of its Receſſes, is manifeſt, not only from the Inſtances above Alledged, but many others. Percolate it with all the Care imaginable, filter it with never ſo many Filtrations, yet ſome *terreſtrial Matter* will remain; 'tis true, the Fluid will be thinner every time than other, and more diſengaged of the ſaid Matter: but never wholly free and clear.

I have *filtred Water*, thro' ſeveral Sheets of thick Paper, and after that, thro' very *cloſe fine Cloth*, 12 times doubled, nay, I have done this over and over, and yet a conſiderable Quantity of this Matter diſcover'd it ſelf in the *Water* after all. 'Tis true, *Filtring* and *Diſtilling* of *Water* intercepts, and makes it quit ſome of the *Earthy matter* it was before impregnated withal, but then that which continues with the Water after this, is fine and light, and ſuch conſequently, as is in a peculiar Manner fit for the Growth; and *Nouriſhment of Vegetables.* And this is the Caſe of *Rain-water*; the quantity of *terreſtrial Matter* it bears up into the *Atmoſphere* is not great: But that which it does bear up, is mainly of that light kind of *Vegetable Matter*, and that too perfectly diſſolved, and reduced to ſingle *Corpuſcles*, all fit to enter the *Tubules* and *Veſſels* of *Plants.* On which Account tis, that this *Water* is ſo very fertile and prolifique. But the *mineral Matter* is a great *Deal* of it, not only groſs and ponderous, but ſcabrous and inflexible, and ſo not diſpoſed to enter the Pores of the Root. And a great many of the *ſimple Vegetable Particles* by Degrees unite, and form, ſome of them, ſmall Clods or *Moleculæ*; ſuch as thoſe mentioned in *H. K.* and *L.* ſticking to the *Extremities* of the *Roots* of thoſe Plants; others of them intangle in a looſer Manner, and form the *Nubeculæ*, and green Bodies ſo commonly obſerved in *ſtagnant Water.* Theſe alſo when thus conjoyned, are too big to enter the Pores, or Aſcend up the Veſſels of *Plants*, which ſingly they might have done; they who are converſant in Agriculture, will eaſily ſubſcribe to this. They are well aware, that be their Earth never ſo rich, ſo good, and ſo fit for the Production of *Corn*, or other *Vegetables*, little will come of it, unleſs the Parts be ſeparated and loſe. 'Tis on this Account, they beſtow the Pains they do in *Culture* of it, in *Digging*, *Plowing*, *Harrowing*, and *Breaking* of the *clodded Lumps* of *Earth.* 'Tis the ſame way that *Sea Salt*, *Nitre*, and other *Salts*, promote *Vegetation*, they looſen the Earth, and *ſeparate* the concreted Parts of it, by that Means fitting and diſpoſing them to be Aſſumed by the *Water*: and carried up into the *Seed* or *Plant*, for its *Formation* and *Augment.* There's no Man but muſt obſerve, how apt all ſorts of Salts are to be wrought upon by Moiſture, how eaſily they liquate and run with it: and when theſe are drawn off, and have deſerted the Lumps, wherewith they are incorporated, thoſe muſt Moulder immediately, and fall aſunder of Courſe. The hardeſt Stone we meet with, if it happen, as frequently it does, to have any ſort of Salt intermixt with the Sand of which it conſiſts, upon being expoſed to humid Air, in a ſhort time diſſolves and crumbles all to pieces, and much more will clodded *Earth* or *Clay*, which is not of near ſo compact and ſolid a Conſtitution as Stone is. The ſame Way likewiſe is *Lime* ſerviceable in this Affair: It is well known how apt it is to be put into Ferment and Commotion by *Water*, nor can ſuch Commotion ever happen, when *Lime* is mixt with *Earth*, however Hard and Clodded that may be, without Opening and Looſening of it.

4. *The* Plant *is more or leſs Nouriſhed and Augmented in proportion as the Water in which it ſtands, contains a ſmaller or greater Quantity of* proper *Terreſtrial Matter* in it. The *Truth* of this Propoſition, is ſo eminently diſcernable through the whole Proceſs of theſe *Tryals*, that I think no Doubt can be made of it. The *Mint* in the *Glaſs. C.* was much of the ſame Bulk and Weight with thoſe in *A.* and *B.* But the Water, in

which that was, being *River-water*, which was apparently ſtor'd more copiouſly with *Terreſtrial Matter* than the *Spring* or *Rain Water*, wherein they ſtood were, it had thriven to almoſt double the Bulk that either of them had: and with a leſs Expence of Water too. So likewiſe the Mint in *L.* in whoſe Water was diſſolved a ſmall Quantity of good Garden Mould, tho' it had the Diſadvantage to be leſs when firſt Set, than either of the Mints in *H.* or *I.* whoſe *Water* was the very ſame with this in *L.* but had none of that *Earth* mixed with it: yet in a ſhort time, the Plant not only overtook, but much outſtripped thoſe, and at the End of the Experiment, was very conſiderably bigger and heavier than either of them. In like Manner, the Mint in *N*, though leſs at the Beginning than that in *M.* being ſet in that thick, turbid, feculent Water, that remained behind, after that wherein *M.* was placed, was ſtill'd off, had, *in fine*, more than doubled its original Weight and Bulk, and received above twice the additional Encreaſe than that in M. which ſtood in the thinner diſtill'd Water had done; and which is not leſs conſiderable, had not drawn off half the Quantity of *Water* that that had.

Why in the Beginning of this *Article*, I limit the *Proportion* of the *Augment* of the *Plant* to the *Quantity* of proper *terreſtrial Matter* in the *Water*, is, becauſe all, even the *Vegetable matter*, to ſay nothing of the *mineral* is not proper for the Nouriſhment of every Plant. There may be, and doubtleſs are, ſome parts in different Species of Plants, that may be much alike, and ſo owe their Supply to the ſame common Matter: But 'tis plain, all cannot. And there are other parts ſo differing, that 'tis no ways credible they ſhould be formed all out of the ſame ſort of Corpuſcles. So far from it, that there want not good *Indications*, as we ſhall ſee by and by, that every kind of *Vegetable* requires a peculiar and ſpecifick Matter for its Formation and Nouriſhment. Yea, each Parts of the ſame *Vegetable* does ſo, and there are very many and different Ingredients go to the *Compoſition* of the ſame individual plant. If therefore the Soil, wherein any *Vegetable* or *Seed* is planted, contains all, or moſt of theſe *Ingredients*, and thoſe in due *Quantity*, 'twill grow and thrive there, otherwiſe, 'twill not. If there be not as many ſorts of *Corpuſcles* as are requiſite for the Conſtitution of the main and more *Eſſential parts* of the Plant, 'twill not proſper at all. If there be theſe, and not in a *ſufficient Plenty*, 'twill ſtarve, and never arrive to its *Natural Stature*; or if there be any the leſs neceſſary and eſſential Corpuſcles wanting, there will be ſome Failure in the *Plant*, 'twill be defective in Taſte, in Smell, in Colour, or ſome other way.

But tho' a *Tract* of *Land* may happen not to contain *Matter proper* for the *Conſtitution* of ſome one peculiar kind of *Plant*, yet it may for ſeveral others; and thoſe much differing among themſelves. The *Vegetative particles* are commixt and blended in the *Earth*, with all the Diverſity and Variety, as well as all the Uncertainty conceivable.

It is not poſſible to imagine how one, uniform, homogeneous *Matter*, having its Principles or original parts, all of the ſame Subſtance, Conſtitution, Magnitude, Figure and Gravity, ſhould ever conſtitute *Bodies* ſo egregiouſly unlike in all thoſe Reſpects as *Vegetables* of *different Kinds* are: Nay, even as the different *Parts* of the ſame Vegetable. That one ſhould carry a *Reſinous*, another a *Milky*, a third a *Yellow*, a fourth a *Red Juice* in its *Veins*; one afford a *Fragrant*, another an *Offenſive Smell*; one be ſweet to the *Taſte*, another *bitter*, *acid*, *acerb*, *auſtere*, &c. that one ſhould be nouriſhing, another poyſonous, one purging, another aſtringent: In brief, that there ſhould be that vaſt Difference in them, in their ſeveral *Conſtitutions*, *Makes*, *Properties* and *Effects*, and yet all ariſe from the very ſame ſort of *Matter*, would be very ſtrange.

The *Cataputia* in the Glaſs *E* received but very little Increaſe; only 3½ *gr.* all the while it ſtood, tho 2501 *gr.* of *Water* were ſpent upon it. I will not ſay the Reaſon was, becauſe that *Water* did not contain in it *matter* fit and proper for the *nouriſhment* of that peculiar and remarkable *Plant*. No, it may be the *Water* was not a proper *medium* for it to grow in; and we know there are very many *Plants* that will not thrive in it. Too much of that Liquor in ſome *Plants*, may probably hurry the *terreſtrial matter* thorow their *Veſſels* too faſt for them to arreſt and lay hold of it. Be that as it will, 'tis moſt certain there are peculiar Soils that ſuit peculiar *Plants*. In *England*, *Cherries* are obſerved to ſucceed beſt in *Kent*; *Apples* in *Herefordſhire*; *Saffron* in *Cambridgeſhire*, *Woad* in two or three of our *midland Counties* and *Teazles*, in *Somerſetſhire*. This is an Obſervation that hath held in all parts of the World. But that Soil that is once proper and fit for the Production of ſome one ſort of *Vegetables*, does not ever continue to be ſo. No, in Tract of Time, it loſes that Property: but ſooner in ſome Lands, and later in others. If *Wheat*, for Example, be ſown upon a *Tract* of Land, that is proper for that Grain, the firſt Crop will ſucceed very well, and perhaps the ſecond, and the third, as long as the Ground is in Heart, as the Farmers ſpeak: But in a few Years 'twill produce no more, if ſowed with that Corn. Some other Grain indeed it may, as *Barley*; and after this has been ſown ſo often, that the Land can bring forth no more of the ſame, it may afterwards yield good *Oats*; and perhaps *Peaſe* after them. At length 'twill become barren, the *Vegetative matter* that at firſt it abounded withal, being educed forth of it, by thoſe ſucceſſive Crops, and moſt of it born off; each ſort of Grain taking forth that peculiar *Matter* that is proper for its own Nouriſhment.

After all which, that very Tract of Land may be brought to produce another Series of the *ſame Vegetables*; but never till it is ſupply'd, with a new Fund of *matter*, of like ſort with that it at firſt contained. This Supply is made ſeveral Ways: By the Grounds lying fallow ſome time, 'till the Rain has poured down a freſh Stock upon it; or by the *Tiller*'s Care in manuring it.

And for further Evidence that this Supply is, in Reality, of like ſort, we need only reflect a while upon thoſe Manures that are found, by conſtant Experience, beſt to promote *Vegetation*, and the *Fruitfulneſs* of the

Earth.

Earth; theſe are chiefly either *Parts* of *Vegetable*, or of *Animals*; which indeed, either derive their own Nouriſhment, immediately from *Vegetable Bodies*, or from other Animals that do ſo. In particular, the *Blood*, *Urine* and *Excrements* of *Animals*, Shavings of *Horns* and of *Hoofs*, *Hair*, *Wool*, *Feathers*, *calcined Shells*, *Lees* of *Wine*, and of *Beer*; *Aſhes* of all ſorts of *Vegetable* Bodies, *Leaves*, *Straw*, *Roots*, and *Stubble*, turned into the Earth by *Plowing*, or otherwiſe to rot and diſſolve there; theſe, I ſay, are our beſt Manures, and being *Vegetable Subſtances*, when refunded back again into the *Earth*, ſerve for the *Formation* of other like Bodies.

We meet with ſtill further Confirmations of the ſame things in our *Gardens*. The *Trees*, *Shrubs* and *Herbs*, cultivated in theſe, after they have continued in one Station, till they have derived thence the greater Parts of the *matter* fit for their *Augment*, will decay and degenerate, unleſs either freſh Earth, or ſome fit Manure be applied unto them. 'Tis true, they may maintain themſelves there for ſome time, by ſending forth *Roots*, further and further to a great Extent all round, to fetch in more remote Proviſion: But at laſt all will fail, and they muſt either have a freſh Supply brought to them, or they themſelves be removed and tranſplanted to ſome Place better furniſhed with *matter* for their *Subſiſtence*. And accordingly *Gardiners* obſerve, that *Plants* that have ſtood a great while in a Place have longer *Roots* than uſual; part of which they cut off when they *tranſplant* them to a freſh Soil, as now not of any further Uſe to them.

All theſe Inſtances, to paſs over a great many others that might be alledged, point forth a *particular terreſtrial matter*, and not *Water* only for the *Subject* to which *Plants* owe their Increaſe. Were it *Water* only, there would be no Need of Manures, or of *tranſplanting* them from Place to Place. The *Rain* falls in all Places alike; in this Field, and in that, indifferently; in one Side of an *Orchard*, or *Garden*, as well as another; Nor could there be any Reaſon, Why a Tract of Land ſhould yield *Wheat* one Year, and not the next, ſince the Rain ſhowers down alike in each.

5. *Vegetables are not Formed of Water, but of a certain peculiar terreſtrial Matter.* The *Plant* in *E.* drew up into it 2501 *Gr.* of the *Fluid Maſs*; and yet had received but 3 *gr.* and a *half* of Encreaſe from all that. The Mint in *L.* tho' it had at firſt the *diſadvantage* to be much leſs than that in *I*, yet being ſet in *Water*, wherewith *Earth* was plentifully mixed, and that in *I.* only in *Water* without any ſuch *Additional Earth*, it had vaſtly outgrown the other, weighing at leaſt 145 *gr.* more than that did, and ſo having gained above twice as much as that had. In like Manner, that in *K.* tho' it was a great deal leſs when put in than that in *I.* and alſo was impaired and offended by *Inſects*, yet being *planted* in *Water* wherein the *Earth* was diſſolv'd, whereas the *Water* in which *I.* ſtood, had none, it not only overtook, but conſiderably ſurpaſſed the other; weighing at leaſt 29 *gr.* more than that in *I*, and yet had not expended ſo much *Water* as that, by above 2400 *Gr.* The *Plant* in *N.* tho' at firſt a great deal leſs than that in *M.* yet being *Set* in the *Foul Craſs Water*, that was left in the Still, after that in which

M.

M. was ſet was drawn off, in Concluſion had gained in Weight above double what that in the finer and thinner *Water* had. The *Proportion* of the *Augment* of that Plant that throve moſt, was to the fluid Maſs ſpent upon it, but as 1. to 46. in others it was as 1. to 60. 100. 200. Nay in the *Cataputia*, 'twas but as 1. to 714. The Mint in *B* took up 39 *gr.* of *Water* a Day, one Day with another, which was much more than the whole *Weight* of the *Plant* originally, and yet, with all this it gained not one fourth of a Grain a Day in *Weight*. Thoſe that in *H.* took up 253. *gr.* a Day of the *Fluid*, which was near twice as much as its original Weight, it weighing when firſt ſet in the Water but 127 gr. and after all the daily Increaſe of the Plant, was no more than $2\frac{1}{7}$ *Grains*,

6. *Spring and Rain Water contain pretty near an equal Charge of Vegetable Matter: River Water more than either of them.* The *Plants* in the Glaſſes *A. B.* and *C.* were at firſt of much the ſame Size and Weight. At the end of the *Experiment*, the Mint in *A.* had gained 15 *Gr.* out of 2558 *gr.* of *Spring-Water*; that in *B.* $17\frac{1}{2}$ *gr.* out of 3004 *gr.* of *Rain Water*, but that in *C.* had got 26 *gr.* out of only 2493 *gr.* of *River Water*. So that theſe *Proportions* will hold for the Main: Yet I make no doubt, but the Water that falls in Rain at ſometimes, contains a greater Share of *terreſtrial Matter*, than that which falls at others. A more powerful and intenſe Heat muſt needs hurry up a larger Quantity of that *Matter* along with the humid Vapours that form Rain, than one more feeble and remiſs ever poſſibly can. The Water in one *Spring* may flow forth, with an higher Charge of this Matter, than that of another: This depending partly upon the Quickneſs of the *Ebullition* of the Water, and partly upon the *Quantity* of that *matter*, latent in the *Strata*, through which the *Fluid* paſſes, and the greater or leſs *Laxity* of thoſe *Strata*. For the ſame Reaſon, the Water of one River may abound with it more than that of another. Nay, the ſame River, when much *Agitated*, and in *Commotion*, muſt bear up more of it, than when it moves with leſs Rapidity and Violence. That there is a great Quantity of this *Matter* in Rivers, and that it contributes vaſtly to the ordinary Fertility of the Earth, we have an illuſtrious Inſtance in the *Nile*, the *Ganges*, and other Rivers, that yearly overflow the Neighbouring Plains. Their *Banks* ſhew the faireſt and largeſt Crops of any in the whole World. They are even Loaded with the Multitude of their *Production*, and thoſe who have not ſeen them, will hardly be induced to believe the mighty Returns thoſe Tracts make, in Compariſon of others that have not the Benefit of like *Inundations*.

7. *Water ſerves only for a Vehicle to the Terreſtrial Matter, which Forms Vegetables, and does not it ſelf make any Addition unto them.* Where the proper *Terreſtrial Matter* is wanting, the Plant is not augmented tho' never ſo much Water aſcend into it. The *Cataputia* in *E.* took up more Water than the Mint in *C* and yet had grown but very little, having received only $3\frac{1}{2}$ *gr.* of *Additional Weight*, whereas the other had received no leſs than 26 *gr.* The Mint in *L.* was planted in the ſame ſort of Water as that in *K.*

was; only the latter had *Earth* diſſolved in the *Water*, and yet that drew off 13140 *gr.* of the *Water*, gaining it ſelf no more than 139 *Gr.* in *Weight*; whereas the other took up but 10731 *Gr.* of Water, and was augmented 168 *Gr.* in Weight. Conſequently, that ſpent 2409 *Gr.* more of the *Water* than this in *K.* did; and yet was not ſo much increaſed in *Weight* as this by 29 *Gr.* The Mint in *M.* ſtood in the very ſame Kind of *Water* as that in *N.* did: But the *Water* in M. having much leſs Terreſtrial Matter in it, than that in *N.* had, the *Plant* bore up 8803 *gr.* of it, gaining it ſelf only 41 *gr.* the while: Whereas that in *N.* drew off no more than 4344 *gr.* and yet was *Augmented* 94 *Gr.* ſo that it ſpent 4459 *Gr.* of Water more than that did: And yet was not it ſelf ſo much increaſed in Weight as that was, by 53 *gr.* This is both a very fair and a very concluſive Inſtance.

'Tis evident therefore, that *Water* is not the *matter* that compoſes *Vegetable Bodies*; but 'tis the *Agent* that conveys that *matter* to them, that introduces, and deſtributes it to the ſeveral parts for their Nouriſhment. That therefore there is that plentiful Proviſion and vaſt Abundance of it, ſupplied to all the *Parts* of the *Earth*, is a Mark of a *Natural Providence*, ſuperintending over the Globe we inhabit.

This *Fluid* is capacitated for the Office here aſſigned it ſeveral Ways: By the Figure of its Parts; which, as appears from many Experiments, is exactly and Mathematically ſpherical; the Surfaces being perfectly polite, and without any of the leaſt Inequalities. It is evident, *Corpuſcles* of ſuch a Figure are eaſily ſuſceptible of Motion, yea, far above any others whatever, and conſequently the moſt capable of moving and conveying other Matter, that is not ſo active and voluble. Then the Intervals of Bodies of that Figure are, with reſpect to their *Bulk*, of all others the largeſt; and ſo the moſt fitted to receive and entertain foreign Matter in them. Beſides as far as the Trials hitherto made inform us, the *conſtituent Corpuſcles* of *Water* are each, ſingly conſidered, abſolutely ſolid, and do not yield to the greateſt external Force. This ſecures their Figure againſt any Alteration and the Intervals of the *Corpuſcles* muſt be always alike. By the latter it will be ever diſpoſed to receive Matter into it; and by the former, when once received to bear it on along with it. *Water* is further capacitated to be a Vehicle to this *matter* by the *Tenuity* and *Fineneſs* of the *Corpuſcles* of which it conſiſts, We hardly know any Fluid in all Nature, except Fire whoſe conſtituent Parts are ſo exceeding ſubtile and ſmall, as thoſe of Water are. They'll paſs Pores and Interſtices, that neither Air, nor any other Fluid will. This enables them to enter the fineſt Tubes and Veſſels of Plants, and to introduce the *terreſtrial matter*, conveying it to all parts of them; whilſt each, by Means of Organs it is endowed with for the purpoſe, intercepts and aſſumes into it ſelf ſuch *Particles* as are *ſuitable* to its own *Nature*, letting the reſt paſs on through the *Common Ducts*. Nay, we have, almoſt every where, *mechanical Inſtances* of much the ſame Tenor. 'Tis obvious to every one, how eaſily and ſuddenly *Humidity*, or the *Corpuſcles* of *Water* ſuſtained in the Air, pervade and inſinuate themſelves into Cords, however tightly *twiſted*, into *Leather*, *Parchment*, *Vegetable Bodies Wood*, and the like. This it is that fits them for *Hygrometers*, and to meaſure and determine the different *Quantities* of *Moiſture* in the Air, in different Places and Seaſons. How freely *Water* paſſes and carries with it *Terreſtrial Matter*, through *Filtres*, *Colatures*, *Diſtillations*, *&c.* hath been intimated already.

8. *Water is not capable of performing this Office to Plants, unleſs aſſiſted by a due Quantity of Heat: And this muſt concur, or Vegetation will not ſucceed.* The *Plants* that were ſet in the Glaſſes, *Q. R. S. &c.* in *October*, and the following colder Months, had not near the *Quantity* of *Water* ſent up into them, or ſo great an additional Encreaſe by much, as thoſe that were ſet in *June*, *July*, and the *hotter*. That the *Concourſe* of *Heat* in this *Work*, is really neceſſary, appears, not only from the *Experiments* before us, but from all *Nature*: From our *Fields* and *Foreſts*, our *Gardens* and our *Orchards*. We ſee in *Autumn*, as the *Sun*'s *Power* grows gradually leſs and leſs, ſo its *Effects* on *Plants* are *Remitted*, and their *Vegetation* ſlackens by little and little. Its Failure is firſt diſcernable in *Trees*. Theſe are raiſed higheſt above the *Earth*, and require a more *Intenſe Heat* to elevate the *Water*, Charged with their *Nouriſhment*, to the *Tops* and *Extremities* of them; ſo that for Want of freſh *Support* and *Nutriment*, they ſhed their Leaves, unleſs ſecured by a very firm and hardy *Conſtitution* indeed, as our *Ever-greens* are. Next the Shrubs part with theirs, and then the *Herbs* and *lower Tribes*: The *Heat* being at length not ſufficient to ſupply even theſe, tho' ſo near the Earth, the Fund of their *Nouriſhment*. As the *Heat* returns the ſucceeding Spring, they all recruit again, and are furniſhed with freſh Supplies and Verdure. But firſt, thoſe which are loweſt and neareſt the *Earth*, *Herbs*, and they that require a leſſer Degree of *Heat* to raiſe the *Water* with its *earthy Charge* into them, then the *Shrubs* and higher *Vegetables*, in their Turns, and laſtly the Trees. As the *Heat* increaſes, it grows too powerful, and hurries the *matter* with too great Rapidity through the finer and more tender *Plants*. Theſe therefore go off and decay, and others that are more hardy and vigorous, and require a greater Share of *Heat*, ſucceed in their Order.

The ſame is obſervable in diſtant *Climates*; the *Hotter Countries* yield ordinarily, the largeſt and talleſt Trees, and thoſe too, in much greater *Variety* than the colder ever do; even thoſe *Plants* that are common to both, attain to a much greater *Bulk* in the *Southern* than in the *Northern Climes*; nay, there are ſome Regions ſo bleak and chill, that they raiſe no *Vegetables* at all, to any conſiderable Size. This we learn from *Greenland*, from *Iceland*, and other Places of like cold *Site* and *Condition*. In theſe, no *Tree* ever appears, and the very Shrubs they afford are *Few*, *Little*, and *Low*: Again, in the warmer *Climates*, and ſuch as do furniſh forth Trees, and the larger *Vegetables*, if there happen a Remiſſion and Diminution of the uſual *Heat*, their Productions will be impeded and diminiſhed in Proportion. Our late colder *Summers* have given us Proof enough of this. For though the Heat we have had was ſufficient, to raiſe the *Vegetative Matter* in the lower Plants; into our *Corn*, our *Wheat*, *Barley*, *Peaſe* and the like; and we have had Plenty of *Strawberries*, *Rasberries*, *Currans*, *Goosberries*, and the Fruits of ſuch other *Vegetables*, as are low and near the Earth; yea, and a moderate Store of *Cherries*, *Mulberries*, *Plumbs*, *Filberts*, and ſome other that grow at a ſomewhat greater height: Yet our Apples, our Pears, Walnuts, and the Production of the Taller-Trees, have been fewer, and thoſe not ſo kindly, ſo thoroughly Ripen'd, and brought to that Perfection, they were in the former more Benign and warm Seaſons. Nay even the lower Fruits and Grains have had ſome ſhare in the Common Calamity; and fallen ſhort, both in number and goodneſs, of what the hotter and kinder Seaſons were wont to ſhew us. As to our *Grapes*, *Apricots*, *Peaches*, *Nectarins*, and *Figs*, being Tranſplanted hither out of hotter Climes, 'tis the leſs wonder we have of late had ſo general a Failure of them.

Nor is it the Sun, or the Ordinary Emiſſion of the *Subterranean* heat, only, that Promotes *Vegetation*, but any other indifferently, according to its Power and Degree. This we are taught by our Stoves, hot Beds, and the like. All Heat is of like Kind; and wherever is the ſame Cauſe, there will be conſtantly the ſame Effect.

There's a *Procedure* is every Part of Nature, that is perfectly Regular and *Geometrical*, if we can but find it out; and the further our Searches carry us, the more ſhall we have occaſion to Admire this, and the better 'twill Compenſate our Induſtry.

Ground Fertiliz'd by Froſt; By Dr. Beale, n. 56. p. 1140.

LXXII. I do often ask Gardeners, and Skilful Husbandmen, whether all ſorts of Land are more Fertiliz'd, or more ſpeedily, by the Solar Influence in our Climate, or by Froſts; and they generally anſwer, that Froſt and Snow make the quicker Diſpatch amongſt us, and the more general and richer *Fertility*.

Ground *improved by* Brine; By *Dr.* Jackſon. n. 54. p. 1079

LXXIII. All the ground (at *Nantwych*) where Salt or Brine is ſpilt, is when dug up, excellent Muck for *Grazing-Ground*; and even the Bricks that are throughly tinged with it, are very good Muck, and will diſſolve with other Muck, and Fertilize Land conſiderably (eſpecially *Grazing Ground*) for at leaſt 4 Years.

Improvements with Salt; *By Dr.* J. Beal, n. 56. p. 1135.

LXXIV. In the *Weſt* of *England*, ſome Husbandmen make uſe of Brackiſh-Sand, and do find a good Reward when they be at the Charges of carrying it far, for the enriching of their Inheritances: whilſt other Ruſticks will not be intreated to accept of the Brine they have in the midſt of their own Grounds. Certainly the *ſaline* Steams are carried by the Air and Wind much farther from Salt it ſelf in Heaps or Veſſels, than from the Sea-water; from whence the Dews which ariſe in Vapours do deſcend as ſweet and pure as the Dew, which Aſcends from the Earth; and the Rain ſhews no difference. And I give you once an Experimental Proof, that either the *ſaline* Steams, which Aſcend from a Heap of Salt, do Pierce through very thick Stone wall: Or, which I did much rather conceive, they generate more Salt, to a great Depth of Thickneſs, in the *Lime* and *Mortar* of the Walls.

LXXV. The *Sea-ſand* made uſe of in the *Agriculture* of *Cornwall*, is commonly at or near the *Sea-ſhore*; which, to diſtinguiſh from what is uſeleſs, know, that the *Waſh* of the Sea rolls and tumbles *Stones* and *Shells*, *&c.* one over another; whoſe grating makes this Sand. If the Matter be ſhelfy, (as we call it) that is, the Grating of *Stones*, it is of ſmall Value: But if it be notably ſhelly, then it is what we deſire. And of this ſhelly Sand are 3 Colours in our County; about *Plymouth*, and the Southern Coaſt, the Sand is bluiſh, or gray like Aſhes, which I conceive to be from the Breaking of *muſcles* chiefly, and *Oyſter Shells*, mixed with it. *Weſtward*, near the *Lands-End*, the *Sand* is very white, and in *Scilly* Gliſtering: This I think comes from the mouldring of Moor-ſtones, or a kind of Free-ſtone mingl'd with very white Shells, ſuch as are call'd (when the Fiſh are preſerved) *Scallops*. On the *North ſea* about *Padſtow*, and Eaſtwards to *Lundie*, the Sand is rich, and of a brown-reddiſh yellowiſh Colour, and is moſtly of the broken *ſhells* of *Cockles*, which I gueſs to be of that Colour there, from the Waſh of *Severn*, which falls very dirty into the *Severn-ſea*, and perhaps that Accretion of the *ſhells* may be tinged thereby. This we know, that tho' there be little or no Sea Fiſh near the Mouth of the *Severn*, becauſe of the Muddineſs thereof; and therefore Fiſh is carried to be ſold as far as from *Loo* on the South-ſea to *Barnſtable* on the *North*; yet lower down in the *North ſea*, tho' there be not ſo much, yet that which there is, is *fatter* and *better* than that which is taken in the *South-ſea*.

Improvements in *Cornwal*, with Sea Sand, by Dr. Dan. Cox, n. 113. p: 293.

Now beſides theſe Colours of Sands, there is alſo a Difference in the bigneſs of the *Grain*, even in the ſame Harbour of *Plymouth*, in ſome Caves 'tis very ſmall, in others greater grain'd. 'Tis ſaid, that the ſmall is beſt, for the *Tenant*, who only takes to Tillage for 4 Years, becauſe it works ſooner, and yields its ſpeedy Return; the larger grain'd (they ſay) is better for the *Landlord*, and the Land, becauſe it abides longer in the Ground, and makes the Paſture afterwards the *Better*.

In *Falmouth Haven*, near St. *Maw*'s *Caſtle*, there is a ſort of Sand, or rather Coralline, that lies a Foot under the *Ouſe*; which *Ouſe* being removed, and the Bed opened, this Sand is taken up by a Drudge, and is uſed about *Truroe*, *Probus*, *&c.*

Weſt of the Mount in *Portcuthnoe-cove* is a large ſhelly Sand. In *White-ſand Bay*, and about St. *Ives*, it is very white and ſmall. *Vid. Cap.* III. §. XL.

About *Minver*, *Perinſand*, and *Lelant*, the Sands are blown up by the Wind, and drown Abundance of good Land, ſome Houſes, yea and ſome Churches and Chappels are even buried with it; nor has any *Art* been hitherto thought of, to prevent its Devaſtation.

Now of all theſe Sands, the beſt are accounted, as to Colour, firſt the reddiſh, next the blue, then the white; as to kinds, the moſt ſhelly, and the coralline are beſt, and that which is taken up from under the *Salt-water* either by *Dredges*, or being left open by the Ebbing of the *Tide*; the blown Sand is accounted of no uſe, and generally, if Sand be well drained of the ſalt Water, ſo that it may be more conveniently carried, 'tis better than that which has lain long drying in the Sun and Wind, which takes off much of its Vertue.

Theſe uſeful *Sands* are carried by *Lighters* as far up into the Country as the Tides will ſerve to that Purpoſe, and there they are caſt on ſhoar, from whence they are fetched in ſome Places by *Wheels*, but in moſt (by reaſon of the Hillineſs, Narrowneſs and Badneſs of the Ways) on Horſeback; one Horſe carrying about 13 or 14 Gallons. Seven or Eight of theſe Horſes tail'd together, are call'd a *Train*, which one Man drives to 9 or 10 Miles from the Sand Place; where each *Seime*, or *Horſe-load*, with the Carriage, comes to about 8 *d.* or 9 *d.* in ſome Places, though not ſo much in others. For where it is dredged out of the *Sea*, it coſts 12 *s.* or 13 *s.* the *Lighter*, containing ſixſcore *Seime*, at the Landing Key, or Sand-place, but where 'tis loaded from the *Dry Beech* after the Ebb, it is not above 4 *s.* the *Lighter*, and all this Charge of *Lighterage* is beſides the Land Carriage. This Land Carriage I have computed to amount, in the whole County, to about 32000 *l. per An.*

When this *Sand* is brought home, it is ſpread on the Ground intended for *Wheat*; or uſually in the firſt Crop of four, whatever be the *Grain*. For after 4 Crops, 'tis our Cuſtom to leave our Land to Paſture for 6 or 7 Years before we till it again. And indeed the *Graſs* will be ſo good, immediately after Tillage, that we commonly mow it the Firſt Year. This is called Mowing of *Gratten*.

The *Corniſh Acre* is 8 ſcore *Yards* of 18 Foot to the Yard; in one of which Acres, good Husbands beſtow, according to the Nearneſs or Diſtance: near the *Sand* 300 Sacks (that is *Horſe-ſeime* or Burthen;) where Men go 3 *Turn* a Day about 200; where 2 Turn 150; and where but one Turn 80, or 100. And ſo proportionably in greater Diſtance, even to 20 or 30 ſacks on an Acre, rather than none.

The Effect is uſually where much Sand is uſed, the Seed is much, and the Straw little. I have ſeen in ſuch a Place good *Barley*, where the Ear has been even equal in Length with the Straw it grew on. But where leſs Sand is uſed, there is much Straw, and but little, and that Hungry Grain.

After the *Corn* is off, the Graſs becomes moſtly a White *Clovery*, with ſome *Purple*, if the Land be deeper. And this *Graſs* of well-ſanded *Ground*, tho' it be but ſhort, yet as to *Feeding*, giving good *Creams*, Plenty of *Milk*, and all other good Purpoſes, it far exceeds the longer *Graſs*, where leſs *Sand* is uſed. Yea, *Garden Herbs* and *Fruit*, in thoſe Places, are more, and thoſe better in their kind. In thoſe well ſanded Places, alſo little or no Snow lies; there is a continual *Winter-ſpring*, an *Early Harveſt*, (a *Month* or ſix Weeks before what is within 6 or 7 Miles off the Place,) yea ſuch a vaſt

Difference of the *Air* is found in ſo little a Diſtance, that a Man may in an Afternoon travel, as it were, out of *Spain* into the *Orchades*.

We have in this County almoſt all Kinds of ſoils, and ſand agrees very well with each of them.

There is the ſame ſort of *ſhelly ſand* in moſt of the Coaſts of *England*, which lies wholly neglected. In the *Thames* about *Exith*, is taken up a ſort of ſand, not much unlike *Plymouth ſand*, made uſe of only by *Brick-makers*: But one of them told me, that by the ſides of his Sand-heap the Graſs did better ſpring than elſewhere, and turned to a *Clover Graſs*.

'Tis well known that *Sandwich Carrots* and *Peaſe* are well eſteemed, and they grow there, where the Sea-ſand has a little overblown and mixed with the ſoil.

A ſandy Soil manured with Clay, by Dr. Liſter, n. 225. p. 413

LXXVI. There are ſome Towns in the *North-Riding* of *Yorkſhire*, ſtanding upon a light ſandy Soil, *viz. Tollethorp*, *Tollerton &c.* which do all of them manure much of their Ground by *Clay*. This *Clay* is dug hard by, in the Declivity of a Hill. After having bared away two Yards deep of ſand, they ſink a ſquare Pit 6 Yards deep, and 8 or 10 Yards ſquare. The *Clay* is of a blueiſh brown Colour, not ſandy at all, but cloſe and fat, and very ponderous; it burns well for Bricks. They lay 100 Load of Clay upon an Acre of Ground; they dig it at *Midſummer*, and only in a dry Summer. They obſerve, that for 3 or 4 Years it continues yet in Clods upon the Land, and that the firſt Year the Land ſo manured, bears rank, ill coloured, and broad grained *Barley*, but afterwards a plump round Corn like *Wheat*. This Clay Manuring, will by certain Experience laſt 42 Years in the Ground, and that of *Tollethorp*, 48 Years: And then the Ground muſt be clayed again.

This ſandy Ground, unleſs clayed, will bear nothing but *Rye*, whatever other *Manure* or *Lime* your *Compoſt* be; but once clayed, it will bear *Oats*, *Barley*, *Peaſe*, *&c.*

Improvements by Marling by Mr. Thomas Wright, n. 37. p. 729.

LXXVII. The greateſt Improvement of our Husbandry in *Suffolk*, hath been by *Marling*, for 50 *Load* of *Marle* to an *Acre* of *Dry*, *Barren*, *Lingy Heath*, make (as they ſay) a very great Improvement both for *Corn*, *Turneps*, *Clover-Graſs*, *Nonſuch*, and *Cole-ſeed*. Of the 3 firſt, I ſuppoſe, I need to ſay nothing; but of the *two Laſt*, (which are late *Experiments*) I have received a very good Account from ſome *Norfolk Gentlemen*; one of whom, the laſt Year, had of 7 *Acre* of *Nonſuch*, or *Hop-Clover*, 70 *Combs* of Seed, beſides a great Crop of good Hay, which was twice as much worth as the beſt *Crop* of *Wheat* in this Country. 'Tis ſown (as the common *Clover*) with *Corn*, and when it once takes, it will hold 4 times as long in the Ground. About a Buſhel and an half ſoweth an *Acre*, and the Seed is now brought to 12 *s.* the Comb, (for 4 Buſhels) which was lately at 40 *s.* The ſame Gentleman had the laſt Years 10 *Combs per Acre* of *Cole-ſeed* upon a very *Dry Heath*, only improved by *Marling*.

Improving and draining the Bogs & Loughs in *Ireland*, by Mr. W. King, n. 170. p. 948

LXXVIII. There are few Places in our *Northern* World, but have been famous for Bogs, as well as *Ireland*; every barbarous, ill-inhabited Country has them. I take the *Loca Paluſtria*, or *Paludes*, whither the Ancient *Galls*, *Germans* and *Britains*, retired when Beaten, to be the very ſame we call *Bogs*; And one ſhall find thoſe Places in *Italy* that were barbarous, ſuch as *Liguria*, were infeſted with them; and therefore I believe, the true Cauſe of Bogs is Want of Induſtry. There are many Bogs of late ſtanding in *Ireland*, when *O Donald* and *Tirone* came to the Relief of *Kingſale*, they waſted the Country, eſpecially as they came thro' *Comaught*, which by the Means of the Earl of *Clanrichard*, was generally Loyal; and there is a great tract of Ground now a Bog that was then plow'd Land; and there remains the *Manſion Houſe* of my Lord ——— in the Midſt of it.

Origine of Bogs.

But to ſhew how Want of *Induſtry* cauſes Bogs, it muſt be remembred, that the *Springs* (with which *Ireland* abounds) are generally dry, or near dry in the Summer time, and the Graſs and Weeds grow thick about the Places where they burſt out. In the Winter, they ſwell, and run, and ſoften, and looſen all the *Earth* about them: Now that *Swerd* or *Scurff* of the Earth, that conſiſts of the Roots of Graſs, being lifted up and made Fuzzy by the Water in the Winter, (as I have at the Head of ſome *Springs* ſeen it lift up a Foot or two,) is dryed in the *Spring*, and doth not fall together, but wither in a Tuft, and new Graſs ſprings through it, which the next Winter is again lift up; and ſo the Spring is more and more ſtopt, and the Scurf grows thicker and thicker, till at firſt it make that which we call a *Quaking Bog*, and as it grows higher and dryer, and the *Graſs-Roots* and other *Vegetables* become more putrid, together with the Mud and Slime of the Water, it acquires a Blackneſs, and grows into that which we call a Turf Bog: I believe when the *Vegetables* rot, the Saline *Particles* are generally *Waſhed* away with the *Water*, as being apt to be Diluted in it: But the Oily or Sulphureal, are thoſe that chiefly remain, and ſwim on the *Water*, and this is that which gives Turf its *Inflammability*.

To make this Appear, 'tis to be obſerved,

1. That in *Ireland*, our *Higheſt Mountains* are covered with Bogs, as well as the *Plains*, becauſe our *Mountains* Abound more with Springs than can be imagined.

Now no Body living on our *Mountains*, and no Care being taken to clear the *Springs*, the whole Mountains are over run with Bogs.

2. It is to be obſerved, that *Ireland* doth abound in *Moſs*, more than, I believe, any other Kingdom.

Now this Moſs is of divers Kinds, and that which grows in *Bogs*, is remarkable; your light ſpungy *Turf* is nothing but a *Congeries* of the *Threads* of this Moſs, as I have frequently obſerved, before it be ſufficiently rotten. and then the Turf looks white and is light: I have ſeen it in ſuch Quantities,

tities, and ſo Tough, that the *Turf-Spades*, could not cut it; in the North of *Ireland*, they call it *Old-wives Tow*, being not much unlike Flax. The *Turf-holes* in time grow up with it again; and all the little Gutters and Bogs are generally filled with it. And truly I chiefly impute the Red, or Turf Bog to it; and from it even the hardned Turf when broken, is Stringy; though there plainly appear in it Parts of other *Vegetables*. And I am almoſt (from ſome Obſervations,) tempted to believe, that the Seed of this *Bog-moſs*, when it falls on dry and parched Ground, begets the Heath. However the Moſs is ſo Fuzzy and quick growing a *Vegetable*, that it mightily Stops the Springs; and contributes to thicken the Scurf, eſpecially in *Red-Bogs*, where only I remember to have obſerved it.

3. It is to be obſerved, that the bottom of *Bogs* is generally a kind of white *Clay*, or rather *Sandy Marle*; a little Water makes it exceeding Soft, and when it is dry it is all Duſt. So that the Roots of the Graſs do not ſtick faſt in it: but a little wet looſens them, and the Water eaſily gets in between the Surface of the Earth and them, and lifts up the Surface, as a *Dropſy* doth the Skin.

4. 'Tis to be obſerved, that *Bogs* are generally higher than the Land about them, and higheſt in the middle; the chief Springs that Cauſe them being commonly about the middle, from whence they Dilate themſelves by Degrees. If you cut a deep Trench through a *Bog*, you will find the Original Spring, and vaſt Quantities of Water will run away, and the *Boy* ſubſide; the *Bog* at *Caſtle Forbes*, (as I was informed) ſubſided 30 Foot. I could hardly believe that; but found by Computation, that it could not be much leſs than half of it.

I muſt confeſs there are *Quaking Bogs* cauſed otherwiſe; when a ſtream, or ſpring, runs thro' a flat, if the Paſſage be not tended, it fills with Weeds in Summer, Trees fall a croſs it and dam it up; them in Winter, the Water Stagnates farther and farther every Year, till the whole flat be covered. Then there grows up a courſe kind of *Graſs*, peculiar to theſe *Bogs*; this Graſs grows in *Tufts*, and their Roots conſolidate together, and yearly grow higher, inſomuch that I have ſeen of them to the height of a Man.

This Graſs Rots in Winter, and falls on the Tufts and the Seed with it, which Springs up next Year; and ſo ſtill makes an Addition. Sometimes the tops of Flags and Graſs are interwoven on the Surface of the Water, and this becomes by degrees thicker, till it lie like a Cover on the Water; then Herbs take Root in it, and by a *Plexus* of the Roots it becomes very ſtrong, ſo as to bear a Man. I have gone on *Bogs* that would riſe, before and behind, and ſink where I ſtood to a conſiderable Depth; under which was Clear Water.

The *Inconveniencies* of theſe *Bogs* are very great.

1. A conſiderable Part of the Kingdom is rendered uſeleſs by them, they keep People at a diſtance from one another, and conſequently hinder them in their Affairs, and weaken them; for it is certain, that if ſuppoſe a Thouſand Men Live on 4 Contiguous Acres, they can both better aſſiſt, and defend one another, than if they liv'd on 4 not Contiguous.

Inconveniencie of Bogs

2. The Land which generally ſhould be our Meadows, and fineſt eveneſt Plains are covered with *Bogs*. This I obſerved through all *Connought*, but more eſpecially in *Longford*, and likewiſe in *Weſt Meath*, and in the North of *Ireland*.

3. The *Bogs* are a great Deſtruction to Cattle, the chief Commodity of *Ireland* In the Spring time, when the Cattle are Weak and Hungry, the Edges of the *Bogs* have commonly Graſs; and the Cattle venturing in to get it, fall into Pits or Sloughs, and are either drowned, or (if they are found) ſpoilt in the pulling out.

4. They are a Shelter and Refuge to *Torys* and *Thieves*, who can hardly Live without them.

5. The Fogs and Vapours that riſe from them are commonly Putrid, Stinking and very Unwholſome. For the Rain that falls on them, will not ſink into them, there being hardly any Subſtance of its ſoftneſs, more impenetrable by *Water* than *Turf*; and therefore Rain Water ſtands on them, and in their Pits; it Corrupts there, and is all Exhaled by the Sun, very little of it running away, which muſt of neceſſity affect the Air.

6. They Corrupt our *Water*, both as to its Colour, and Taſte: for the Colour of the *Water* that ſtands in the Pits, or lies on the Surface of the *Bog*, is Tinctured by the Rediſh Black Colour of the Turf, and when a ſhower comes, that makes theſe Pits to overflow, the *Water* that runs over Tinctures all it meets, and gives both its Colour and Stink, to a great many of our Rivers.

Advantages. 1. The Natives nevertheleſs had heretofore ſome Advantage by the *Woods*, and *Bogs*. By them they were preſerved from the Conqueſt of the *Engliſh*, and I believe it is a little Remembrance of this that makes them ſtill Build near *Bogs*. It was an Advantage then to them to have their Country unpaſſable, and the fewer Strangers came near them, they lived the eaſier, for they had no Inns; every Houſe where you came, was your Inn and you ſaid no more, but put off your *Broges* and ſet down by the Fire.

2. They are alſo now of ſome uſe to us; for moſt of *Ireland* have their Firing from them; Turf is accounted a tolerable ſweet Fire; and we having very impolitically deſtroyed our Wood, and not as yet found *Stone-Coal* ſave in few Places, we could hardly live without ſome *Bogs*. I have ſeen *Turf* Charked; and then it ſerves to Work Iron, and as I have been informed, will ſerve to make it in a Bloomery or Iron work. *Turf* charked I reckon the ſweeteſt and wholſomeſt Fire that can be, fitter for a Chamber and Conſumptive People, than either *Wood*, *Stone coal* or *Charcoal*.

3. A *Turf Bog* Preſerves things ſtrangely; a Corps will lie intire in one, for ſeveral Years. I have ſeen a piece of Leather pretty freſh, dug out of a *Turf Bog*, that had never in the Memory of Man, been dug before. Butter has been found, that had lain above 20 Years: And tho' not fit to be Eaten, yet it ſerved well enough to Greaze Wool.

Trees are found intire in them, and thoſe *Birch* or *Alder*, that are very ſubject to Rot. The Trees are ſuppoſed by the Ignorant vulgar to have lain there ever ſince the Flood ; but the Truth is, they fell on the Surface of the Earth, and the *Bog*, as I ſhewed above, ſwelling by degrees, at laſt covered them ; and being of an Oily *Vegetable* Subſtance, it, like a Balſam, Preſerves them These Trees burn very well, and ſerve for Torches in the Night. I have ſeen of the Trees half ſunk into the *Bogs*, and not quite covered.

All the Inconveniencies of our *Bogs*, may be Remedy'd, and they may be made uſeful to us, by Draining ; for I never obſerved one *Bog* without a fall, ſufficient to Drain it, nor do I believe there is any. But the great and weighty Objection againſt this Improvement is the Charge ; an *Acre* of good Land in moſt parts of *Ireland*, is about 4*s.* *per Annum*, and the Purchaſe 14 or 15 Years, and therefore 3 *l.* will Purchaſe an Acre of good Land, and it is very doubtful with Moſt, whether that Sum will reduce a *Bog*. This reaſoning paſſes Current, and is the great Obſtacle and Impediment of this Work ; but if theſe things following were done, and conſidered, I verily believe it would be remov'd.

The Inconveniences Remedy'd by Draining.

1. An Act of Parliament ſhould be made, that who did not in ſuch a Time make ſome Progreſs in Draining their *Bogs*, ſhould Part with them to others that would ; and allow a Paſſage to them thro' their Lands.

2. 'Tis to be conſidered, that in *Quaking Bogs* one Trench Drains many Acres: And when dry, it is generally Meadow, or the beſt Grazing Ground.

3. Every *Red Bog* has about it a Deep, Marſhy, Sloughy Ground, which they call the Bounds of the *Bog*. One deep Trench round the *Bog* keeps out the Cattle, and turns the Bounds into good Meadow.

4. I Remember a *Red-Bog* of 60 Acres which a Gentleman reduced to good Grazing Ground, worth 3*s.* an Acre, for 25 *l.* which is leſs than 3 Years Purchaſe.

5. Gentlemen ought to conſider, that what they lay out this way, goeth by Degrees, and they are not Senſible of it ; it goeth among the Tenants, and enables them to pay their Rent the better ; 'tis a Work of Charity, and employs Hands ; and Conduces to both the Ornament and general Profit of the Kingdom.

6. To make the *Red Bogs* fit for Grazing, theſe Rules may be obſerved.

1. A deep Trench muſt be made round the *Bog*. This not only only Reduces the Bounds of the *Bog* as before, but goes a great way to dry the *Bog* it ſelf. It ſerves likewiſe as a Common Sink, into which all your Drains vent themſelves.

2. Obſerve which way the little Sloughs run in the *Bog*, and be ſure to Cut your Drains a croſs them.

3. The firſt Drains on the *Bog*, ought not to be above 2 or 3 Foot deep or wide ; For the *Bog* is ſo ſoft that deep Trenches will not ſtand but fill up again. When the Surface of the *Bog*, is cut in little *Trenches*, ſuppoſe

at 20, 30, 40. Perch diſtance, it will be ſo dryed, that Cattle may Graze on it all Summer.

4. A Year or two after the little *Trenches* are made, and the *Bog* a little dry, they are to be made 6 Foot wide, and as deep as the Softneſs of the *Bog* will permit. And this will certainly make the *Bog* uſeful for Grazing. A Year or two after this, you may attempt to cut one or two of the Trenches to the bottom of the Bog; for till that be done, I do not reckon the Bog ſecured.

5. A Gentleman ought to oblige all his Tenants, to cut their *Turf* in theſe *Trenches*, and likewiſe cut his own ſo.

6. Where a Bog is Pitted, he is to cut a Paſſage from one Pit to the next for the Water, and ſo make a Communication to the Common Drain; and if his Pits be once dryed there will grow *Graſs* or *Heath* at the bottom, fit for *Grazing*, and they will be a ſhelter for Cattle in Storms.

7. When his *Bog* is dryed, it is thereby made better *Turf*, and then he is to ſet out a part of it for that uſe, and to oblige them to cut it clear away: And the Bog being removed, the bottom will make a good Meadow.

8. He may cut off the Surface of the *Bog* and burn it: Or elſe bring Earth and lay on it. Sanding or rather Gravelling is a great Improvement in this Country; the Land ſo Manured will bring Corn 12 or 14 Years. They ſay Gravelling is bad for *Graſs*: But the contrary is apparent, eſpecially in Bogs. I have obſerved by the Way ſide, where the Ways paſs thro' Bogs, if a little Earth hath fallen on the Bog, as ſome times there doth fall a little of that which they bring to mend the High-way, it has turned the Bog into a Green Sod, with a very fine *Scutch Graſs* on it: And I doubt not but the ſame Chrages, that Sands or Gravels Land, would Reduce a dryed Bog, even to be Arable.

Improvements of Loughs. The Natural Improvements of Loughs, or Lakes, is firſt to Drain them as low as we can; and then turn the Reſidue of the Water into Fiſh Ponds: By Planting a few Trees about them, and ordering them thus, they may be made both Uſeful and Ornamental.

And Turloughs. *Vid. Sup cap.* II. §. XIX. As to thoſe Places we call *Turloughs*, *quaſi Terreni Lacus*, or *Land Lakes*, they anſwer the Name very well, being Lakes one part of the Year of conſiderable Depth, and very ſmooth Fields the reſt. There are in theſe Lakes Holes out of which the Water riſeth in Winter, and goeth away towards Summer: Many Hundred Acres being drowned by them, and thoſe the moſt Pleaſant and Profitable Land in the Country. The Soil is commonly a *Marle*, which by its ſtifneſs hinders the Water from turning it into a Bog; and immediately when the Water is gone, it hardens ſo that you ride thro' an even Graſſy Field. Theſe, if they could be Drained, would be fit for any uſe, would make Meadow, or bear any Grain, but eſpecially Rape, which is very Profitable. They are chiefly in *Connought*; and their Cauſe is Obvious enough. It is a Stony Hilly Country, and the Hills have Cavities in them through which the Water paſſes; it is common to have a Rivulet ſink on one ſide of a Hill, and riſe a Mile or half a Mile from the Place. The Brooks are generally dry in Summer; the Water that ſhould be in them, ſinking between the Rocks, and running under Ground; inſomuch as that in ſome Places where they are overflow'd in Winter, they are forced in Summer to ſend their Cattle many Miles for Water. There is one Place on a Hill near *Tuam* between two of theſe *Turloughs*, where there is a Hole the Superſtitious People call the *Devil's Mill*, and make Fables concerning it: If you ſtand by this Place, you will hear a great Noiſe like that of *Water* under a Bridge: When there is a Flood in Winter, one of the *Turloughs* Overflows, and Vents it ſelf into the Hole: And the Noiſe doth, in all likelyhood, proceed from a *Subterraneous Stream*; which in Summer has room enough to Vent all its Water, but in Winter when Rains fall, the Paſſages between the Rocks cannot Vent the Water, and therefore it *Regurgitates*, and covers the Flats.

Theſe *Turloughs* are hard to Drain; often they are encircled with Hills, and then 'tis not to be expected; often they have a Vent by which they ſend out a conſiderable Stream, and then it is only making that Paſſage as low as the bottom of the Flat, and that will prevent the Overflowing; it ſometimes happens that the Flats are as low as the Neighbouring Rivulets, and in all Probability are filled by them, and then it is not only Neceſſary to make the Paſſage from the Flat to the Rivulet, but likewiſe to ſink the Rivulet, which is very troubleſome, commonly the Paſſage to be cut being Rocky: And therefore a good Computation (upon a *Survey*) ought to be made, whether it be worth the while to attempt it. However the Holes ought to be opened that the Water in its Ordinary Courſe may get ſooner away; And they are to be eaten very Bare towards the End of Summer, that as little *Graſs* as is Poſſible may be Spoilt by the Water.

LXXIX. 1. *Jun.* 7. 1697. near *Charleville*, in the County of *Limerick* in *Ireland*, a great Rumbling or faint Noiſe was heard in the Earth, much like unto the ſound of Thunder near ſpent; for a little Space the Air was ſomewhat Troubled with little Whisking Winds, ſeeming to meet contrary ways; and ſoon after that, in the Bog of *Kapanihane*, upon the Eſtate of *Brook Bridges* Eſquire, ſtretching North and South, the Earth began to move, *viz.* Meadow and Paſture Land that lay on the ſide of the Bog, and ſeparated by an Extraordinary large Ditch, and other Land on the further ſide adjoyning to it; and a Riſing, or little Hill in the middle of the Bog hereupon ſunk Flat.

The Motion a Bog in Ireland; By . . . n. 233. p. 714

This Motion began about 7 of the Clock in the Evening, fluctuating in its Motion like *Waves*, the Paſture Land riſing very high, ſo that it overrun the *Ground* beneath it, and moved upon its Surface, rowling on with great puſhing Violence, till it had covered the Meadow, and is held to remain upon it 16 Feet deep.

In the Motion of this Earth, it drew after it the Body of the *Bog*, part of lying on the place where the Paſture Land, that moved out of the place it had before, ſtood; leaving great Branches behind it, and ſpewings of *Water*, that caſt up Noiſome Vapours.

2. The Line *A.B.* is the *Meridian*; *C.* a *Meadow*, containing 3 *Engliſh* Acres, and 32 Perches; *D.* firm Paſture-Land (but of a Courſe Boggy Subſtance) containing 4 Acres 3 Roods. The Line 1 2 was a Hedge of large Aſh and Willow-Trees, between the Meadow and the firm Land; 3, 4 was the Edge of the Bog next to the Paſture. The Prick'd Lines from 3 to 5 and from 4 to 6 ſhew the Limits or Bounds of the Bog. The Meadow *C.* was lower, by a Deſcent of 5 Foot, than the Paſture *D.* and the Paſture *D.* was lower by 6 Foot than the Surface of the Bog. And there was yet a conſiderable riſing and Hill, as at *E*, the height whereof was more than 10 Foot above the Surface of the Bog, ſo that there was a Deſcent from *E.* to the Meadow.

Fig. 176.

The Cauſe of the Motion I preſume was this; a more than Ordinary *Wet Spring* occaſioned a Prodigious ſwelling of the height of the Bog at *E.* and at length Moiſtened the whole, but chiefly the under part thereof, the *Water* ſoaking to the bottom. By this means the *Turfy Hill E.* being as it were undermined, naturally ſunk down, and conſequently preſſed the Bog on all Hands, chiefly towards the Deſcent, till the Paſture *D.* was forced on the Meadow *C.* overturning the intermediate Hedges, ſo that the Line 3, 4 is now become 1, 2. and the Meadow and the whole Bog are level, only there are *Chaſms* and great *Cracks* throughout the whole Surface of the Bog, repreſented by the Stroaks about *E.* The Bog contains 40 Acres.

The Spaniſh Sembrador and its Uſes, By the E. of Sandwich. n. 60. p. 1056.

LXXX. In the Deſcription of this *Sembrador*, (Publiſh'd by *Don Joſeph de Lucatello*, Knight, Inventor of the Engine, and Dedicated to Signor Don *Geronymo de Camargo*, Counſellor of the *Conſejo Real de Caſtilla* and of the *Hazienda Real*) it is repreſented;

Firſt, That both the Ancient and Modern Husband-Man have agreed, that the Perfection of *Agriculture* conſiſted in ſetting the Plants in Proportionable Spaces, and giving ſufficient Depth to the Roots, that they may ſpread enough, to receive that Nouriſhment from the Ground which is neceſſary to produce and ripen the Fruit.

2. That Care hath not been had, in the Practice of this important part of Husbandry; ſince even at this Day, all ſorts of Seeds, of Corn and Grain, are Sown by Handfuls; throwing them out by Aim, Heedleſly and by Chance (counting it too Tedious and Chargeable to ſet them one by one in large Fields.) Whence we ſee Corn ſowed in ſome places too thick, in others too thin, and the greater part of it not covered, nor deep enough; whereby it is not only expoſed to be Eaten by Birds, but alſo in Cold Conſiderations, *D. Joſeph de Lucatello* hath after much Experience perfected an Inſtrument, which being faſtned to the Plough, at once Ploughs, Soweth, and Harrows; whereby is ſaved the Labour of the Seeds Man; and the Grain falling in Order, and in the bottom of the Furrow, all of it remains in one and the ſame diſtance under *Ground*, ſo that of 5 parts of

Seed, 4 parts are ſaved; and then in the Crop is gained Incredible Abundance.

3. That the Inventor preſented it at the Feet of his *Catholick Majeſty*, who cauſed Tryal to be made thereof in the *Byen Retiro*, where it did anſwer Expectation, notwithſtanding the Drought of the Year, then much Damnifying all Corn; an ordinary Husband Man from a meaſured ſpace of *Ground* there, ſowed in the common manner, reaping 5125. where he by his Contrivance from an equal ſpace of *Ground* there alſo, Reaped 8175 beſides the Seed ſaved in the Sowing.

4. That thereupon his ſaid *Catholick Majeſty* did grant to the *Inventor*, the Privilege, that he only and his Aſſigns may Make and Diſtribute theſe Inſtruments, in all the Kingdoms and Provinces of that Monarchy in *Europe* at the Price of 24 *Rials Plate* each, and out of *Europe* 32 *Rials Plate*, of which the 5*th* part ſhould be paid to the King: Prohibiting to all others the Making and Uſing this Inſtrument under ſeveral Penalties.

5. That before the *Inventor* came to the Court of *Spain*, he made a great Tryal of it before his *Imperial Majeſty*, in the Fields of *Laxemburg* in *Auſtria*, where the Land uſually yields Four or Five fold: But the Crop from the ground ſowed with this Inſtrument was Sixty fold; as appears by a Certificate given in *Vienna Aug*. 1. 1663. *ſt. n.* by an Officer of the *Emperor* appointed to ſee the ſaid *Ground* Sowed and Reaped.

6. That this Privilege being diſpatch'd, he Publiſh'd his Contrivance and Inſtructions as follows.

1. Fig. 177. Is a Box of Wood; *a. b. c. d.* the Cover of that part where the Corn is put in; (which is open in Fig 178. at *w*.) And *e. f. h. g. k. l.* *Fig* 177. 178.
the two ſides which Cover that part of the Box, where the *Cylender*, which is ſtuck round with 3 Rows of little Spoons, is moved about to throw out the Corn, (which ſides are taken off in Fig. 178. to make the *Cylinder R. S.* with the *Spoons x. x. x. appear.*) The inner ſhape of theſe ſides is expreſſed in Fig. 179. where may be ſeen four Triangular pieces *p. p. p. p.* eaving Triangular Interſtices *q. q. q.* which ſerve to Conveigh the Corn *Fig.* 179.
arried up in the Spoons, and diſcharged at the top of the *Cylinder*, ſo as hey may juſt run out at the Holes underneath the Box; (the Parts of which Anſwer to the Parts of Fig. 177. according to the Letters.) *T* is one f the Wheels; *V.* the other end of the *Cylender*, upon which, the other Wheel is to be placed.

2. This *Sembrador* muſt be tied faſt to the *Plough*, in the manner as is *Fig.* 180.
en in Fig. 180. ſo that the Corn may fall in the Furrow, and at the turn-g of the Plough, the Ears of the Plough may cover the Corn of the laſt urrow with Earth.

3. Becauſe the Seed ſow'd by this Inſtrument is placed in a Convenient Depth, *viz.* in the bottom of the Furrow, whereas the Seed ſcattered the common way, remains nearer the Superficies of the Earth, or quite uncovered, therefore it muſt needs ſhoot forth ſomewhat later: So that it is Requiſite, the Husband-man, uſing this Inſtrument, ſhould Sow 8 or 10 Days ſooner than the accuſtomed Seed-time; *viz.* beginning to Sow in the middle of *September*, and making an end at the middle of *November*.

4. In Stiff Ground the Furrows ought to be 5 or 6 Inches deep; in middle ſort of Ground, 6 or 7; and in light and ſandy Ground 7 or 8 Inches; and according to this Proportion, the Husbandman muſt govern himſelf, deepning or ſhallowing the Plough, as the Condition of the Land ſhall require.

5. Special Care muſt be had, that the Wheels on the ſides of the Inſtrument do always turn round, and never drag along, without turning; as alſo, that the Ears of the Plough be made ſomewhat bigger than the ordinary ones.

6. 'Tis alſo Convenient, that the Seed be well ſifted and cleaned; that ſo the little Spoons may every time take up a Grain and the Seed be the better Diſtributed.

7. In *Barley* 'tis to be well obſerved, that it be made Clean in that manner, that the Straw and Beards be broken off, as near the Grain as may be: That ſo they hinder not the Iſſuing of the *Grain*, out of the Inſtrument.

8. After Seeds-time done, Furrows muſt be made to drain the Land of Water, according to the uſe of each Country, without doing any thing more Extraordinary, till the Harveſt.

The following Inſtructions were alſo Publiſh'd.

1. Before they Sow the Ground, they muſt give it ſo many *Tilths* as is accuſtomed in that Country where the Land lyeth.

2. When they go about to Sow, the Ploughman muſt begin to open a Furrow with the Plough for one or two Paces; and when the Plough is in the Ground in a Convenient Depth, then they muſt tye the *Sembrador* to the Plough-Beam, ſo that the Nails in the Wheels may ſtand upon the *Ground* to make the Wheels turn round.

3. The Ears of the Plough are to be made larger than hitherto: Whence two Advantages will ariſe. 1. It will better cover the Furrows when Sown, and make Wider Furrows to receive the Seed when they do Sow. 2. Thoſe larger Ears will prevent the Blows, the great Clods and Stones will give the *Sembrador* (if the Clods be not broken, and the Stones pick't out.) But when there are ſuch great Stones in the Land, as the Plough cannot Penetrate, then the Plough Man by lifting up his Plough muſt paſs over it, until he meets with Mould again; and ſo muſt the *Sembrador* alſo be lifted up, the Weight thereof being but very little, and no conſiderable Trouble to the Ploughman.

4. When the Clods and Stones cannot be maſtered with only one pair of

Ear

Ears, you muſt add another pair of them to the *Plough*, 4 or 5 Inches higher than the firſt (chuſing a fit Place in the *Beam* to place them in) although behind the others a little; for ſo, the *Sembrador* will be perfectly ſaved and defended. And the *ſecond Ears* are to be of the ſame Bigneſs with the firſt. And this is found, by Experience, to be the beſt Remedy againſt the Stones and Clods.

5. The time of ſowing, according to the moſt experienced Farmers, is when the Mould of the Land is dry, or but a little enclining to Moiſture: In either of which Conditions of the Land, this new *Sembrador* works without clogging the Wheels, or ſtopping up with Dirt, thoſe Holes through which the Grain is to iſſue forth.

6. When this *Sembrador* works as it ought to do, it will ſow three *Celamines*, or about a Peck of Wheat, and five *Celamines*, (or $\frac{5}{12}$ of a Buſhel) of *Barley*, on as much Land as would take up about $1\frac{1}{2}$ Buſhel after the common way of Sowing. And if it much exceed or fail of this Proportion, it noteth ſome Fault in the Inſtrument, or Careleſsneſs in the Plowman.

7. The *Spoon* muſt be made for all Seeds, proportionably to their Bigneſs.

8. You muſt plow the Furrows very cloſe one to another, that ſo the Plough when it turns back, may the better cover the laſt Furrow, which is left open, and ſowed as it came along.

9. After having ſown the Land, in the ſame Manner the Land ſhould be made as plain as can be, and no ſuch *Furrows* made to carry away the Water as hitherto hath been uſed: But it will be ſufficient, that at every 4 *Yards* Diſtance (one from the other) *Furrows* be made. For Experience hath taught us, that the Land laid up without *Furrows*, bears more Corn, than that which hath more *Furrows*, becauſe the *Wheat* and *Barley*, and other Plants, receive greateſt Damage by Drought; and therefore this ought more eſpecially to be obſerved in *Spain*, one of the dryeſt Countries of *Europe*.

10. In many Parts of *Spain*, in 1664. it was found, that Land ſown in *September* hath yielded a better *Crop*, than that which was ſow'd in *October*, and that ſown in *October*, better than that ſown in *November*; which Proveth, that 'tis more advantageous to ſow early than late.

11. They have obſerved alſo, that it is very profitable to ſow in the *New Moon*, becauſe it will ſhoot forth, and thrive, and ripen ſooner. In *Spain*, *Italy*, and the Iſlands of the Mediterranean, they may begin the firſt *New-moon* in *September*, and ſo go on, and end with the *New-moon* in *November*: But in *Germany*, and the *Low Countries*, they begin in the End of *Auguſt*, and end with the *New-moon* of *October*.

Agreſtick Obſervations and Improvements, by Dr. J. Beal. n. 1[illegible]. p. 359.

LXXXI. It is vulgarly known, that the ſurface of ſome Ground is ſo hollow, light, and ſwoln by a hot and working Ferment, that it muſt needs ſend up a *warming Steam*, as appears by the quick Riddance of all the Snow that falls on it, and (in many places within my Knowledge) diſſolving the *Snow* before it falls on the Ground; that ſome Stones by an innate *Warmth*, and ſome *Waters* do impregnate the *Earth*, and that other Stones by their contrary Qualities. or by their Poſitions, have a quite contrary Operation; that ſtreams of Water running over *Lime-ſtones*, or through Veins of *Marle*, or of that ſort of *Chalk* which is kind for Manure (for there is a ſort of *Chalk* which is *Barren*) doth fertilize; that ſome other Waters are hungry, uliginous and corroſive; and that thoſe Rivers which are filled with a black Water, by Rain running over Heaths, do much Miſchief where they overflow, begetting *Heath* all over the *Paſtures*.

In the ſharpeſt Froſt that I have known theſe many *Years*, the Ground having been alſo ſome days covered with Snow, I ſaw a ſmall *Stream* (no bigger than might run from the Mouth of an ordinary *Quart Glaſs-bottle*) ſliding merrily, and ſmoaking all the way over the *Lawns*. I could not diſcern, that any Snow had fallen within 5 or 6 *foot* on each ſide; (if it did, none remained there;) and ſo far the Graſs at that time, about *Chriſtmas*, was as green as any Leek, and the *Froſt*, (ſo far) apparently diſſolved. Of this I then wrote to our worthy Friend Mr. *Evelyn*, not for any Wonder, (for perhaps there are, or may be Thouſands of ſuch *ſmoking ſtreams* in *England*,) but only repreſenting how ſuch a Stream may warm a Manſion, and cheriſh tender Evergreens well ſhelter'd from Winds, and flowry *Gardens*, all the hard Winter, and do us better ſervice in an extream hot Summer. I have been perplext in obſerving my ſelf, an hundred times, the difference of *Heat* and *Cold* between two Villages within a Mile of each other, where we could obſerve no diſparity of Hills or Rivers; only the Springs in the one were all ſhallower, in the other, ſome were deeper. In a large Tract of Land the ſurface was of ſo hot a Ferment, that at every Step I trod up to the Ankles. I cauſed it to be examined by the Spade, and found it, as far as I tried here and there, at a foot depth, as thick ſet with *Pebble ſtones*, as if a Cauſey had been pitch'd there, yet was it a quick and pregnant Land for *Flowers*, *Fruit-trees*, and *Vines*, theſe *Pebbles* being diſlodged, and ſome of them carried away. I have ſeen Fields where the Surface did ſeem covered with *Pebbles*, not *Flinty* nor *Limeſtone*, yet they bore full Burdens of the beſt and cleaneſt *Rye* and *Oats*: The Husbandmen took away the *Pebbles* from off the Surface, and then the Land bore as ſtrong *Wheat*, *Peaſe* and *Barley*, as before it bore *Oats* and *Rye*. In other parts where I have been, the Husband-men took away the Stones which ſeemed to cover the Fields, and ſuſtain'd great Loſs for their coſtly Labour; their Corn was much weaker for ſome Years after. I can attribute theſe differing Events to nothing, but the Difference of Stones: Some intrinſically warm, and impregnating above Ground, ſome cold and not impregnating, whilſt in that *Poſition* or *Situation*. Yet ſome Experience forbids me to deny, that even ſuch Stones, when covered with *Earth*, at a certain Depth, may *increaſe* the Fertility of the *Land*. And the hot and bibulous *Land*, which drinks up the *Rain* and *Snow* as ſoon as it falls, ſeems to have ſome cooling Refreſhment from under Ground Pebbles, which are of a cold, ſtiff, and ſullen *Nature*.

What I have to ſay of *warming* and *fertilizing Rocks*, I ſhall deliver with an aſpect towards *Scotland*, for *Horticulture*. I had ſeveral times Conference with Sir *Robert Morray* B. M. (who was an Honour to his Country, and a Bleſſing to the place where he abode) concerning *Eſculent* and *Olitory Gardens*, and (under one) *Nurſeries* of *Fruit trees*, and other uſeful *Vegetables* in *Scotland*. I repreſented, that, almoſt within my Memory, they are become the chief Relief of *England*, that 'tis lately found, that *auſtere Fruit* yield ſtrong and ſprightful Liquor, which reſembles the *Wine* of the *Grape*, that the Return of Gain from *Gardens* is great and ſpeedy; *Nurſeries* neither a chargeable nor a burthenſome Addition, but a congruous Engagement of the multitude to perſevere in the nobleſt kind of *Agriculture*. Sr. *R. M.* granted all that I ſaid; and I am ſure, he acted and executed all that he could for the Good of his own Country, and for *England*, *&c.* But ſaith he, there are ſo many Rocks, and ſuch bleak Winds in *Scotland*, that they can hardly draw in the ſame Yoke with *England* for *Gardens* and *Orchards*. I replied, that in *Devon* and *Cornwal*, they fenced their *Gardens* and *Orchards* with *Flanders Firrs* and tall *Holly* from the Sea-winds; and they have lofty *Firs*, and goodly *Pines* in *Scotland*: and *New-England*, where the Winds are as keen, and the *Snow* and *Froſt* as deep, and as long laſting, as in many Parts of *Scotland*, is yet full of fruitful *Orchards*. And if *Scotland* be farther in the North, yet *Norway* is rich in *Boſcage*, and the Seeds of the *Hemlook-Tree*, *Spruce* and *Cedars*, from *New-England*, *New-Found-Land*, and *Virginia*, may perhaps rejoyce in the *Exchange* of *Northern America*, for the North of this Iſland.

This I told Sr. *R. M.* I durſt undertake, that when *Edinburgh*, and their *Towns* and *Univerſities* ſhall plant *Kitchen Gardens*, as we do now in *England*, they ſhall receive their grateful Reward the firſt Year, and bear the Charges of their *Nurſeries* abundantly, and ſo hold on; and within 7 Years, ſecure their Poſterity of the Benefit, and delight themſelves with the Fruit of their pleaſing Labour.

Now for fertilizing Rocks, I made bold to repeat it often, That within a days Journey of the Heart of *England*, I could ſhew 3 Gardens the beſt that I have ſeen for flowry Beauties, *Engliſh Ever-greens*, and *Sallads*, all the *Winter* long; all theſe on a hard Rock, in moſt Places but one Foot deep under Earth; in ſome two, in few Places three Foot deep; very lofty Hills cloſe on the *South-ſide*, the Declivity of the Gardens due *North*; and the *Rock* perfectly bare next to the Walls on the *North ſide*. And I ſaw rich *Hop-Yards* n the ſame Caſe, but in deeper Ground, next to the Garden on the South ide of the *Garden*; and theſe *Northern Hop-Yards* eſcaped many Blaſts, which eiz'd on the *Hop-Yards* on the South-ſide of the *Hill*. On the ſteep Aſcent, n the *North-ſide* of one of theſe rocky Hills, where no *Plough* could come, I w a Gentleman *Plowing* up the *ſhallow Turf* with a *Hand Plough* for *Flax*, nd I ſaw good *Flax* grow there, to the Largeneſs of a *Village Field*. His *Hand Plough* had a Stem of *Aſh* or *Sally*, about 7 Foot long, and a Plate on ne Side near the End, to turn the *Turf*; a Coulter to be let out ſhorter or longer, to cut the Turf 4. or 5. or more *Inches* deep, as the Land affords it; and a ſmall Iron Wheel. This *Hand Plough*, the Maſter and his Man by turns, drove before them with a walking Speed; having Leathern Aprons before them to ſave their Cloaths. For the Cauſes of this hardy Fertility, *Viderint Philoſophi.* I am ſure of the Truth of what I write, and I am willing to apprehend, that if in *Scotland* they did, in fit Places, ſow the beſt Flax-ſeed of *Flanders* as many here do, they would make good *Holland*. *Linen*, *Laune*, and *Cambrick*, as now they do *Scotch Cloth.*

It is no hard *Task* to ſhovel down the ſhallow and moſſy Turf, from the ſteepeſt Declivities of Rocks, into Places where it may have ſome *Receptacle* or Stay, and there to impregnate it with the Spade and Compoſt, for *Gardens* or *Vineyards*. And there the *Tenth Part* of an *Acre* in Gardening may yield more Profit than 10 *Acres* of ordinary Tillage in a *Corn Field*.

I am ſo much a Stranger to *Scotland*, that I cannot ſay, whether *Saffron*, *Liquorice*, *Hops*, *Madder*, *Oade*, or what other Rich Commodities do proſper there; but this I know, that our *Engliſh Saffron* and *Liquorice*, do far excel all the Foreign, which our *Druggiſts* do ſell us from the South. And ſince *Vines* and *Mulberries* have travelled from the remoteſt *Eaſt*, through all the hotteſt Countries, and have abundantly enriched our next Borderers, and have received acceptable Hoſpitality, as far as they have been tried, in this our Iſland; we have Encouragement enough to Adventure the cheap and eaſie Tryal.

364.
3.p.816 Some of my Correſpondents tried the *Mulberry* and *Silkworm* as far in the North as *Huntingdonſhire* and *Cheſhire*, and Sir *James Craig* tried them in the moiſteſt Place of *Ireland*, in the County of *Cavan* in *Ulſter*; and all boaſted their Succeſs, *An.* 1651, 1652, 53, 54, 55. Wherever Mulberries grow, I am apt to expect, that the Worms will live, and ſpin, and furniſh the *Silken-Trade*.

In *Devonſhire*, they mingle black Mulberries fully ripe, with a full Bodied *Cyder*, in the time of Grinding or Preſſing the Apple, with Diſcretion for Tincture and Reliſh: And they eſteem it a very wholſome and ſtout Wine.

V. ſup. §
XXIX. 2 'Tis ſtrange, that in 9 or 10 Years ſince this was publiſhed, the Practice hath not been ſpread into other Countries, where they abound with ſtrong and Winy Cyder; many being willing that their Cyder ſhould in Tincture reſemble *Claret*, *Tent*, or *Alicant Wine*. But it may ſeem, that we do yet Retain ſomewhat of our Father's Averſneſs from Planting *Mulberries*, which they ſhewed near the Beginning of King *James* his Reign, to our great Loſs and Shame.

The *Mulberry* requireth a Rich, Succulent and Rank Ground, which is not wanting in the Approaches of any of our Cities and Towns. And Mr. *Evelyn* hath written as well as can be written, both to inſtruct and to encourage the Planting of them.

The *White Mulberries* (as we call them) are for the fineſt Silk; but to mingle with *Cyder*, and for our Junkets, (as *Palladius* hath hinted to us) we ſhould ſend for the moſt delicious black *Mulberries* which may be had in *Naples*, *phis*, *Sicily*, *Virginia*, or any of the *Eaſt* or *Weſt-Indies*, not truſting to the *Seed*, but by all Means to have young Plants, of the beſt ſorts, ſent in Boxes containing ſome of the connatural Soil. Thus if the Gardens about *London* were well furniſh'd, they might eaſily be diſperſed into other Parts, without more ado: For, few Plants may be more eaſily propagated, when they are young. A few rooted *Mulberries* being preſſed down, and covered with Earth in fit Places, ſo that the Eyes may be very lightly covered, and the *Sprouts* or *Branches*, if there be any, may be cut very near to the Ground; or a good *Branch*, after due depth of the bigger End in the Rich Mould, thus ordered as before, will ſoon become a perpetual *Nurſery*; And if the worſt *Mulberries* were well diſperſed, they may be ſoon amended, by putting the largeſt black Mulberry upon that of the ſmall kind; it being certain, that it takes better upon that than upon the white *Mulberry*.

Vinous Shrubs are now coming into Faſhion, of theſe do ſome make *Sugar Wines* by Art, to be compared (for Wholſomneſs and Pleaſantneſs, to many Palates) with Rich Wines of the *Grape*. For the *Sugar-Cane* doth hardly yield to any Vine in the World: and we hope that *Meath*, *Metheglin*, and other *Honey Drinks*, will in a ſhort time give Place to theſe *Sugar-wines*, when perfectly well made.

Beſides, 'tis good Employment for the poor Women and Children to gather the Fruit, and a ſpecial Improvement of our waſte Lands and Heaths, only by turning the Turf and burnt Heath (if there be any) into the *Trenches* and *Pits*, made by the Plough or Spade, for *Banks* or *Beds*.

Many diſcourage themſelves from *Planting Cyder-Orchards*, ſaying, that if they had the Fruit, they ſhould yet want many Matters, too coſtly for them. For their Sakes, I ſhall here inſtance, that in all the Neighbourhood round about *Yeoville* in *Somerſetſhire*, they that make 20 Hogſheads of *Cyder*, yearly, and much more, do pound all their Fruit in *Troughs*, made for the purpoſe, deep and ſtrong, with *Broad Footed Pounders*, one, two, or three, as their need requireth, pounding together in the ſame Trough. And to me they hold the Paradox ſtoutly, that without more Coſt or Trouble, this is the beſt and cheapeſt Way. Workmen are cheaper in the Country at ſome Seaſon, than in ſome Cities. And 'tis a Charity to employ Men that want Employment, rather than Beaſts; and ſometimes 'tis unſafe to truſt either to the Wind, or to the Water. n.134.p.866

Cyder, you know, coſts no Fewel to brew it, and the Labour is but once in the Year.

'Tis drawn by divine Chymiſtry, ſo many *Trees*, ſo many huge *Alembicks*, which attend to that divine Work conſtantly all the Year, they need no *Furnaces* to ſend forth a corroding Smoke to choke all the City, to ſtrangle them into Conſumptions, and to corrupt all Beauties and Amenities. Neither *Iron*, *Steel*, nor *Marble*, can reſiſt the Fumes of *Brewing-Houſes*: whereas *Cyder* is of a thouſand Kinds, proper to cure many Diſeaſes, and a kind Vehicle for any Healing Vegetable, or other medical Matters.

The *Cyder* of the beſt *Pepins* duly ripen'd and kindly fermented, is a peculiar Remedy for the *Conſumption*, and generally all ſtrong and pleaſant *Cyder* exciteth and cleanſeth the Stomach, it ſtrengthneth *Digeſtion*, and infallibly frees the *Kidneys* and *Bladder* from breeding the *Gravel* and *Stone*. This is (above all) the peculiar Excellency of the right *Red-ſtrake* of *Irchin Field*, when it eſcapes all Sophiſtications. But that which makes *Cyder* fit to accompany the *Trades-men's Granary* is, that if it be made of right *Cyder-fruits*, ſo that it will be full bodied and ſtrong, it will hold good without decay, and will yearly be much improved for ſome Years, to the next plentiful Year, as uſually it falls out, and beſt of all in large Veſſels, the larger the better. *Tradeſmen* ſhould not be for bottled Cyder, which is commonly more windy than healthful. It hath been tried from my Childhood in Veſſels of 14, 15 or 16 Hogſheads, of the free Houſhold Meaſure, containing 60 or 70 *Statute Gallons*; I have been often told, that Sir *John Winter* had a Veſſel which contained 30, or at leaſt 28 *Hogſheads*.

When the Citizens ſhall ordinarily drink Cyder well diluted, as the *French* drink *Wine*, and as the ſober People in all our Cyder Countries drink their *Waſhings* of Cyder, as they call it, or Cyder well diluted in the *Grinding-time*, and as they drink in *London* their 6 *ſhilling Beer*, I am perſwaded it will much conduce to their Health; and I have often heard labouring People affirm, that they are more ſtrengthned for hard Work by Cyder largely diluted, than by very good Beer.

Yet I have much more to ſay for *Houſhold-Gardens*, as a fit Match for *Granaries*. *Coleworts* and *Cabbages*, with a little Care, hold out 7 or 8 Months in the Year. We have them all the *Year* round; good Sauce for *Bacon* as red as any Roſe, as they have it in *Herefordſhire*, where the Swine will get a Share of the Fruit which fall from their Hedges, and the *Bacon* of *New-Foreſt* is generally commended. Theſe are in good Houſes always at hand, and may be eaſily dreſſed without Waſte of much Time. But Roots of all ſorts, *Rapes*, *Turneps*, *Carrots*, *Parſneps*, *Skirrets*, *Potatoes*, do challenge the Precedence before *Granaries*; they are a kind of *Under Ground Granaries*, and do often-times hold out, when Corn faileth; eſpecially the *Potatoes* of *Barbadoes*, or of *Virginia*.

Vid. ſup. § 8. The *Potatoes* of *Barbadoes*, in our freſh Memory, relieved *Ireland* from two *Years Famine*, when their Corn failed there; as *Cheſnuts* relieved *France* in the Extremity of their civil War, when their *Ploughs* were forſaken. Theſe *Potatoes* coſt little or no Culture for 10 Years together, being only covered with *Fern*, or other light *Muck*, and that turned in with the *Earth*, and 2 or 3 Roots, as often as there is Occaſion to take any of them up for Uſe; and they ſhould be taken up here and there, by ſmall Parcels, where they grow thickeſt. A few *Acres* of theſe will run far to furniſh a City, and the Country round about. They have been ſold in the *Markets* of *Briſtol* and *Wells*, at the Price of 4 *ſhillings per Buſhel*, dear enough in Reſpect of their eaſie Propagation and Culture, and cheap enough in Reſpect of their Uſe. Children of poor People thereabout eat them raw, inſtead of *Bread* and other *Food*, without Hurt; ſome do roaſt them in *Embers*, as they do *Wardens*, ſome do *boyl* them, peel them, and eat them with *Butter* and *Pepper*, either ſerved whole or chopt, as they do Parſneps; ſome do ſtrengthen their *Beer* or *Ale*, or make good Drink with them, ſo they are to them inſtead of Corn and Malt, and an acceptable *Treat*. Every way they are a ſtrong and wholſome *Nouriſhment* for *Labourers*. Some do parboil them ſlightly, peel them, and mince or cut 'em in ſmall Bits, mingle 'em with Slices of fat Fleſh, ſeaſoning all to their Palate, and bake them in Pies or Paſties, and they eſteem them a reſtorative Delicacy, not much inferior to *Artichoaks*. I obſerve them to grow and proſper abundantly in much differing kinds of Soil, from the *North* of *Shropſhire* to the Sea-Coaſt of *Dorſetſhire*. But they like not a ſtiff and ſtrong Land. I tryed them 2 Years in a ſtrong *Wheat Land*, and could get no good of them there; all the Roots which were there generated, were little bigger than the Bulbs of *Saffron*. In light and hollow Land of the *hotteſt Ferment*, which is commonly of little Worth for Corn or Paſture, there *Potatoes* thrive beſt and taſte beſt. But now I am at a Difficulty, whether the great Difference which we find in the Reliſh, be from the differing Kinds of the *Potatoes* of *Barbaboes* and *Virginia*, for both have the ſame Reſemblance above Ground: Or, whether the Difference which we find be only from the Diverſity of the *Soyl*.

That the Soil makes a great Difference, and that all may be careful to choſe a fit Soil for their *Garden-Dyet*, I ſhall here offer ſome notable Inſtances to prove it. All the People here, (the very Vulgar) do find the *Carrots* and *Turneps* or *Rapes*, from the common Field of *Mariot*, 8 Miles from hence, weſtward; far to excel other very good *Turneps* and *Carrots* in Fatneſs and pleaſing Reliſh. And *Cabbage Plants* from the wilde Fields of *Lydiard*, Weſtward of *Taunton*, where they have a rich reddiſh Soyl, do ſo far excel all other the beſt Cabbage-Plants, that theſe *Lydiard* Plants are bought in all Places at 80 Miles Diſtance; and Garden Plants are ſometimes much altered in Taſte and Properties, by the Accidents of the Year. In a droughty Summer, the *Plague* then being hot in *London*, we had Carrots in *Northamptonſhire* from a kind Soyl, where they were wont to be very good; but then ſo rank, dry and earthy, that we could not endure to ſee them on the Table.

I hear that the *Turneps* of *Hackney* are better than any other *Turneps* about *London*. We have here very good *Turneps* white and yellow, which are fatter and eſteemed more reſtorative. But all *England* wants the *Bohemian Turneps*, Blood-red on the outſide, which are extolled by *Muffet*, as he found them in *Prague*, to be ſo reſtorative and delicate, that the Emperor himſelf nurſeth them in his Garden.

The *Spaniſh Potatoe* requires diligent *Culture*, much *Sun* and a light and pregnant *Garden Soil*. In the *Modern Latin* they are called *Glandes malacenſes*, being brought into *Spain* from *Volez Malaga*, a Province in *America*. They report, that more than a Dozen of their huge *Spaniſh* Ships were brought at one time to *Sevil* in *Spain*, fully Fraighted with theſe *Potatoes*, and were ſoon diſperſt all over *Spain*. We ſay the *Spaniard* is ſlow t every thing: But they may ſay, the *Engliſhman* in many Parts of *England*,

is more ſlow at the beſt Improvements of our own Country ; Wi
Want of *Vineyards*, of *Groves*, of *Mulberries*, of the beſt *Cheſ*
Figs, *Almonds*, &c. which are wanting in moſt Parts, and do no
to grow in our Climate.

Improvements of Agriculture, by Dr. M. Liſter, n. 225 p. 413

LXXXII. For the Improvement of ſandy, light *Ground*, or any
well ſanded, I recommend upon Experience *Vicia multiflora Nemor*
rennis, ſive Dumetorum J. B. It hath theſe Qualifications, beſide thoſe
tioned in the Title of *J. Bauhine*, *viz.* of its being *Perennial*, Thriving
in *Woods* and amongſt *Buſhes*, and being of the *Pulſe* or *Pea* Kind, t
ſhoots 1000 Roots far and wide, and ſpreads it ſelf under Ground like
Graſs ; above Ground it is ſo rampant, that it will climb a Fathom a
upon Meaſure, and will preſerve it ſelf in ſpite of *Weeds* or *Drought*.
it may be ſet as well as ſown in Furrows, and for this purpoſe, the Root
be dug up in *Sept.* as well as the ripe Seed then gathered : by this mea
Growth of it would be mightily advanced, for the older the Roots
ſtronger and fuller of *Buds* and *Shoots* they are. I ſow'd the latter
March, the *Seeds* I had gathered in *Sept.* and had that Year a very gre
creaſe ; the Bed being thick covered over with *Graſs* above 2 Foot
but it did not flower that Year. I reckoned that one *Pea* had put forth
Year above 30 *Shoots* in *Auguſt*. In the *ſecond Year*, it flowered by the
dle of *June*, and bore a wonderful Crop, the Roots being innumera
have obſerved this Pea very common in all the Mountains as well as
of *England*, where Buſhes or Hedges are. Both the Pea and Gra
very ſweet, and very agreeable to Cattle, as I have tried.

Agriculture may be alſo conſiderably advanced, by the great Cho
Plants, even of thoſe of our own Growth, of the Pulſe Kind ; of w
recommend this Liſt.

Lathyrus major Latifolius Ger.
Lathyrus Luteus Sylveſtris Dumetorum I. B.
Aſtragalus Sylvaticus Ger.
Vicia Sylveſtris Semine rotundo Nigro C. B.
Orobus Sylvaticus noſtras. C. B. P. in Append.
Vicia Sylvatica Multiflora maxima P. B.

I alſo recommend as Subſtitutes of *Hemp* and *Flax* of our *Engliſh* Gro
viz. Perrennial Plants ;

Linum ſylveſtre Anguſtifolium I. B.
Linum ſylveſtre Floribus Caruleis Ger.

Corona Fratrum ; of the *Thiſtle Kind*. This Plant is generally a *Yard* tal
its Fibres are exceeding tough and ſtrong, beyond any I ever tried ; it pu
forth many of theſe tall and very thick Stalks yearly ; it naturally gro
to this Bulk in moſt barren Soils, as the dry Woolds, and high Paſtures, i
Yorkſhire and *Lincolnſhire*.

It may be objected, that as Annual Plants require more Labour and a fa
ter Soil ; ſo they recompence it in Largeneſs of Growth and Fruit : And al
that Plants of laſting Roots are more harſh and bitter, and not palatab

ſ

for *Man* or *Beaſt*. I anſwer, that the *Compendium* of *Labour*, in *Husbandry*, is all in all; and that therefore the durable Plants will turn to better account: I refer to the wonderful Examples of ſuch as have already been made uſe of at St. *Foin*, *&c.* And it is probable, that by ſome Tillage, even *harſh Plants* may be improved and brought to be kinder Food. The ſame *Aſparagus* which we eat, grows wild in the *Marſhes* of *Lincolnſhire*, very fair, and not to be diſtinguiſhed by the Eye from that in our *Gardens*; but is intolerable bitter, which Garden Culture alone has Civilized, and made pleaſant to the Taſte. For this Purpoſe, Liming of Paſture-Ground makes it palatable to Cattle: For caſt *Lime* over the one half a Paſture, the Cattle will not bite any where elſe willingly, and will Eat here to the *Bare Ground*, much neglecting the other half. I did uſe when I lived in the *North*, to lime my *Aſparagus* and *Lettice Beds*, and this did ſo far meliorate them, that they far exceeded in *Tenderneſs*, and pleaſant Taſte; covering the *Aſparagus* in *Winter*, with clean *Wheat-ſtraw*, inſtead of naſty Litter, and ſowing the Bed thick with the Powder of *Burnt Oyſter-ſhells*.

Perhaps *White Briony*, of all our *Engliſh Plants*, would beſt ſucceed both for *Hay* and *Corn*, as giving the moſt *Graſs*, if we would that way uſe it; and alſo yielding a Root of prodigious Bigneſs, which ſeaſonably taken up, is little elſe but a *Maſs* of *Fine Flower*. 'Tis true, it is a *churliſh Purge*, and not fit Food for Man or any other Animal we keep; But ſuch and much worſe is the *Callava Root*, of which the *Indian Bread* is made, and which by *Exſuccation* and *Baking* alone, proves innocent and wholeſome. If the vaſt Shoots it makes be deſigned for *Hay*, they are to be cut when tender, and in the *Flower*.

To make Plants grow to an extraordinary bigneſs, by M. n.816, p.356

LXXXIII. Sow all ſorts of *Grains*, and plant *Kernels* in Beds of *Earth*, at the very time when the Sun enters into the *Vernal Æquinox*, and take them up when they are ſtrong enough to be tranſplanted, at the Time of the *Full Moon*, which Time is always to be obſerved, if you will take them up, and Replant them again.

But now to know the *Moment*, or very near the *Moment*, of the ſaid *Æquinox*, take ſome Aſhes of *Vine Wood*, put them in an earthen Pot Leaded, or in a Pot of the white *Earth* of *Tayence*, very clean; pour upon it common Water, or Fountain, or Rain-water, that is very clear, from the $\frac{9}{19}$ of *March* to the $\frac{11}{21}$ of the ſame; and at the time when the Sun enters into the *Æquinoctial Point*, you will ſee the *Aſhes* make the *Water Turbid*, and then is the Time of ſowing your *Grains* and planting your *Kernels*.

Gardening improved by Dr. H. Sloan, n. 251, p. 119

LXXXIV. I am of Opinion, that one conſiderable way to improve *Gardening*, and the Culture of *Plants*, would be to give a Deſcription of the *Plants* themſelves, then the *Soils*, *Climates* and *Countries*, where the *Vegetables* to be cultivated naturally grow; and what Seaſons, Rains and Meteors they have; Which being imitated, as much as poſſible, perhaps ſome

Plants might thrive better, than now they do in the fatteſt Ground. And to this purpoſe, I have been aſſured by an honourable and very ingenious Perſon, that he has known ſome Plants, particularly *Centaurium Minus*, which not growing the ordinary way, was tried by dropping the *Seed* on the ſurface of the *Ground* amongſt the *Graſs*, by which *artificial Imitation of Nature*, it came to Perfection, which no other Way could be brought about.

The ſucceſs of a new Stove, by Sr Dudly Cullum, n. 212. p. 191.

LXXXV. I have made a Stove for my *Green-houſe*, according to Mr. *Evelyn*'s late Invention, publiſh'd in the *Calendarium Hortenſe*. I laid my *Pipes* of *crucible Earth*, not too near the *Fire-Grate*, which is about 16 *Inches*, and I made a *Trench* the whole length of my Houſe, under the *Paving*, about 18 Inches in *Breadth* and Depth, covered with an Arch of *Bricks*, and at the other End of the *Trench*, having an *Iron-Plate* about 18 *Inches* ſquare, to take off, and put on, with a round Hole at each *Corner*, of about 3 Inches *Diameter*, with a Lid to ſlide open and ſhut, ſo that by opening any of theſe Holes, or all of them, more or leſs, or taking off the whole Plate, I can Releaſe ſuch a Quantity of Air out of the Houſe, to blow the *Fire* ſo as to increaſe or diminiſh the Blaſts; and as Mr. *Evelin* was pleaſed to inform me by a Letter, concerning diſtributing the Air at its Admiſſion, more equally through the Houſe, I inſerted my Pipes into a Channel all along the *Wall*, at the End of the Houſe, with thoſe ſeveral *Overtures* he mentioned, all which prove admirably.

To make Fruit and Flowers grow in Winter, by Sr Robert Southwell, n. 237. p. 44.

LXXXVI. Take up *Trees* by the Roots in the *Spring*, juſt as they put forth their Buds, preſerving ſome of their own *Earth* about the Roots, ſet them ſtanding upright in a Cellar until *Michaelmas*, then put them into Veſſels, with an Addition of more *Earth*, and bring them into a Stove, taking care to moiſten the *Earth* every Morning with *Rain Water*, in a Quart of which, you muſt diſſolve the Bigneſs of a Walnut of *Salt Armoniack*, and about *Lent*, *Fruit* will appear.

As to Flowers, Take good earthen Pots, and therein ſow your Seed at *Michaelmaſs*, Watering it in the ſame Manner with the like Water, and by *Chriſtmas* you will have Flowers, as Tulips, Lilies, *&c.*

This and the other may be done in a good warm Kitchin; and ſuch Days as the *Sun* ſhines, you may ſet them forth for ſome Hours.

To keep Fruit and Flowers the whole year, by Sr. Rob. Southwell, n. 237. p. 44.

LXXXVII. Take *Salt petre* one Pound, *Bole Armoniack* two Pounds, ordinary clean Sand 3 Pounds; mix all together, and obſerve this Proportion in other Quantities.

Then in *dry Weather*, take *Fruit* of any ſort that is not fully ripe, each with its Stalk; put them in, one by one, into an open Glaſs till it be full, and then cover it with an *Oily Cloth*, cloſe tyed down; then in a dry Cellar, put each of theſe Glaſſes 4 Fingers under Ground, and ſo as that quite round each Glaſs, and above and below, there remain 2 Fingers thick of the ſaid *Mixture*.

Flowers alſo may be uſed in the ſame Manner.

LXXXVIIII. I

Remedies for decayed Evergreens, by Mr. J. Evelin, n. 158. p. 61.

LXXXVIII. I would adviſe ſuch as ſuffer *Detriment* in their *Green Houſes*, not to diſpair, when they ſee the Leaves of their *Myrtles*, *Oranges*, *Oleanders*, *Jaſmines*, and other precious *Fruits*, *Ruſſet*, or altogether ſhrivelled and falling, but to cut them to the *Quick*, plaiſter the Wounds, and plunge their *Caſes* and *Pots*, trimmed with freſh Mold, *&c.* in a warm Bed, carefully refreſhed, ſhaded, aired, and treated as ſick Patients, and as the prudent Gardiner beſt knows how. But above all, that he be ſure, not to expoſe them, 'till the *Eaſtern Winds*, which I call our *Engliſh Eteſiae*, and which make our *Springs* ſo uncomfortable, when we think Winter and all Danger paſt, be qualified; for they are deadly to all our Plants abroad, and frequently do us more Prejudice than the moſt churliſh Winters, as commonly finiſhing the Deſtruction of what the Froſts have ſpared. Nor are we to be flattered with a warm Day or two, which are apt to tempt Gardiners to ſet out their Plants before the End of *April*, or that we find the wiſe Mulberry put forth, which is certainly the moſt faithful *Monitor*; nor ſhould we indeed, cut or tranſplant any of the *Perennials*, till of themſelves they begin to ſprout.

Cautions about expoſing Ever Greens, by Mr. Jacob Bobart, n. 165. p. 777.

LXXXIX. In the Spring, being flattered with ſome warm Glances and refreſhing Days, many are apt to expoſe their choice *Greens*, which upon a ſudden Change to its former cold with ſharp *Eaſtern Winds*, proves more pernicious to ſuch *Strangers* than all the former *Winter*, and ſeems to finiſh the Deſtruction of what the former Cold had ſpared, a Matter too frequently ſeen among us, we enjoying no certain ſteady *Summer* till after the *Solſtice*. But theſe tender *Exoticks* loſing their Leaves, having received Detriment, with their Tops ſhrivelled and the like, are oftentimes not capable of enduring the interpoſing ſcorching Heat of the Sun, which oftentimes happens by Fits in the Spring; when the Prudence and Care of the Gardener is eſpecially tried, gradually to help and recover his ſick Patients, ſometimes by due *Trimming*, *Earthing* with freſh Suſtenance, looſening the ſtrait bound Earth, and ſometimes with the help of a warm Bed, and gentle watering and ſhadowing, and the like, patiently and carefully waiting the Return of the Bounty of the Heavens to help his Endeavours.

In the *Flower Garden*, eſpecial Obſervance ought to be taken of the choicer Roots of the *Aſian Ranunculi*, *Anemoneys*, tender *Narciſſi*, and divers others of the like Tenderneſs, and Strangers to ſuch Entertainments as our *Northern Countries* afford; that if hard Froſt ſhould happen, they ſhould be ſecurely covered and kept from the Froſt, if poſſible, till the too frigid Moiſture of the Earth be digeſted, which would prove pernicious even to the Death and Rottenneſs of many ſuch Roots and Plants.

Vid. ſup. cap. 1. §. LIII.

XC. Papers of leſs General Uſe, Omitted.

n.40.p.793 1. Directions for Tranſporting *Vegetables.*

n.2·0..239 2. *Phytologia Tingitana*; or, an *Alphabetical Catalogue* of Plants growing within the Fortifications of *Tangier*, 1693. by Mr. *Spotſwood.*

n.232.p.677 3. A Catalogue of ſome *Guinea Plants*, with their Native Names and Virtues; ſent by Mr. *J. Smith*, from *Cabo Corſo*, with Remarks on them, by Mr. *James Pettiver*.

n.244.p 313. 4. An Account of 46 *Eaſt Indian Plants*, Collected at *Unmercoonda*, about 12 Miles from *Fort St.* George; by Mr. *Sam. Brown*, with their Names, Deſcriptions, and Virtues, by Mr. *James Pettiver*.

n.256 p.1. n.264.p.579 n.267 p.659 5. An Account of Part of a Collection of curious Plants and Drugs, gathered by Mr. *Sam. Brown*, a Phyſician at Fort St. *George*, in the *Eaſt-Indies*, and lately given to the *Royal Society*, by the *Eaſt India Company.* With Remarks, by Mr. *Pettiver*.

n.19?.p.564 6. Quæries concerning *Indico*, by ——

n.40.p.797. 7. Quæries concerning *Vegetation*, eſpecially the Motion of the Juices of *Vegetables*, by ——

n.43 p 858 862. n.46.p: 919. 8. Quæries concerning the Circles of Wood in the Bodies of Trees, and the Motion of Sap, by Dr. *Ez. Tonge.*

n.44.p 881. n.46.p.914 9. Quæries concerning *Vegetation*, and the Motion of Sap in Fruit-trees, by Dr. *Ez. Tonge.*

n.57 p.1165 10. Quæries concerning *Vegetation*, and the Motion of Sap, by Dr. *Ez. Tonge.*

n.58 p.2673 11. Enquiries, about Retarding the *Aſcent* of *Sap*, and the Motion of *Sap*, by Dr. *Ez. Tonge.*

n 68.p.2074 12. Some further Enquiries concerning the Running of Sap in Trees, colouring the Fruit and Leaves, multiplying *Crabſtocks*, and propagating Trees by *Layers*, *&c.* by Dr. *Ez. Tonge.*

n 70.p.2121 13. Enquiries relating to the Circulation of Sap in Trees, by Dr. *Martin Liſter.*

n 74.p.22.8 14. An Enquiry ſuggeſted from *Italy*, whether it be likely to find ſomething in Plants, analogous to the Heart in Animals.

n.40.p.801. 15. An Invitation to make further Tryal of the Juices of Trees, by Tapping them, by Mr. *H. Oldenburgh.*

n.252.p.186 16. Two Problems concerning the Texture of *Plants*, and the Diſcovery of Poyſon by *Opium*, propoſed by ——.

n.5.p.91. 17. Enquiries concerning *Agriculture*, by the Committee of the Royal Society for conſidering of *Agriculture.*

n.10.p.799. 18. Enquiries concerning the Uſe and Culture of the *Kitchen Garden*, and *Winter Greens*, by ——

XCI. Account of Books, and Additions, Omitted.

1. *Baſis Botanica*: Seu brevis ad *Rem Herbariam* Manuductio, omnes *Plantarum* Partes, una cum earundem *Virtutibus* ſecundum Noviſſima *Botanicorum* Fundamenta, Generali quadam Methodo commonſtrans; a D. *Chriſtiano Ludovico Welſchio*. *Lipſ.* 1697. in 12°. n.243.p.304

2. *Abr. Coulei Angli*, ſex Libri *Plantarum*, Poemate *Latino* conſcripti. *Lond.* in 8°. n.96.p.926

3. *Præludia Botanica Roberti Moriſon*, *Scoti Abredonenſis*, *Lond.* 1669 in 8°. n.46,p.934

4. Dr. *Moriſon*'s New *Univerſal Herbal*.

5. Cl. *Salmaſii* Præfatio in Librum de *Homonymis Hyles Iatricæ*. Ejuſdem de *Plinio* Judicium. *Divione An.* 1668. in 4*to*. n.114.p.327 n.46 p.936

6. Quadripartitum *Botanicum Simonis Pauli*, Med. Reg. in *Dania Argentorati*, in 4*to*. n.76.p.2391

7. Waare Oeffening der *Planten*, door *Abraham Munting*. M. D. *Amſterd*. 1672, in 4*to*. n.111.p.247

8. *Memoires* pour ſervir a l' *Hiſtoire* des *Plantes*; dreſſez par M. *Dodart*. M. D. *Paris*, 1679. Ph. Col. n.18 p.30.

9. *Hiſtoria Plantarum*, ſpecies hactenus editas, aliaſque inſuper multas noviter inventas & deſcriptas complectens. Auth. *Joh. Raii*, e *Soc. Regia*. *Lond.* 1686. in *Fol.* n.186.p.285

10. *Phytographia*; by *Leonard Plukenet*, M. D. *Lond* 1691. *in Fol.* n.193.p.528

11. *Almageſtum Botanicum*; S. *Phytographia Plukenetiana*, *Onomaſticon*, &c. *Lond.* 1696. *in Fol.* n.196.p.618

12. *Catalogus Plantarum Angliæ*, & *Inſularum adjacentium tum* Indigenas, tum in Agris paſſim Cultas complectens. Opera *Jo. Raii*. M. A. 1670. in 12°. & 1677. in 8°. n.225.p.434 n.63 p.1058 n.133.p.834

13. The *American Phyſician*; or a Treatiſe of Roots, Plants, Trees, Shurbs, Fruits, Herbs, &c. growing in the *Engliſh Plantations* in *America*: Whereunto is annexed, a Diſcourſe of the *Coco Nut-Tree*, and the uſe of its Fruit. By *W. Hughs*. *Lond.* 1672. in 12°. n.83.p.4070

14. *Catalogus Plantarum* quæ in Inſula *Jamaica* ſponte proveniunt, vel vulgo coluntur; cum earundem *Synonymis*, & *Locis Natalibus*; adjectis aliis quibuſdam, quæ in Inſulis *Madera*, *Barbados*, *Nieves*, & *Sancti Chriſtophori*, naſcuntur. Seu *Prodromi Hiſtoriæ Naturalis Jamaicæ* Pars prima. Aut. *Hans Sloane*, M. D. 1696. in 8°. n.221.p.293

15. *Icones & Deſcriptiones Rariorum Plantarum Siciliæ*, *Melitæ*, *Galliæ*, & *Italiæ*; Auth. *Paulo Boccono*. 1674. n.104.p.87

n.247.p.460 16. *Muſeo* de *Piante Rare* della *Sicilia*, *Malta*, *Corſica*, *Italia Piemonte* e *Germania*, &c. di Don *Paolo Boccone*, *&c. To which are here Added ſome Remarks by* Mr. *J. Ray.*

n.145.p 100 n.198.p.681 n.200.p.762 n.214.p.876 17. *Hortus Indicus Malabaricus*, continens Regni *Malabarici* apud *Indos* Celeberrimi, omnis generis *Plantas Rariores*, *Amſtel. An.* 1678. 1679. 1682. *&c. To which here are Added ſome Remarks by* Tancred Robinſon, M. D.

n 236.p.29 18. *Hortus Medicus Amſtelodamenſis*, ſive *Plantarum* tam *Orientalis* quam *Occidentalis India*, aliarumq; *Peregrinarum* Deſcriptio & Icones; Autore *Johanne Commelino*, *Latinitate* donatus, *Notis & Obſervationibus* illuſtratus a *Frederico Ruyſchio*, M. D. Botan. Profeſs. &c. & *Franciſco Kiggelario. Amſt.* 1697. *Here are many Additional* Remarks *by* Mr. James Pettiver.

n.249.p.63 19. *Paradiſus Batavus*, continens plus centum *Plantas*, *&c. With Additional Remarks by* Mr. Jo. Ray.

n.199 p.729 20. *Catalogus Plantarum Horti Academici Argentinenſis*: in Uſum *Rei Herbariæ* Studioſorum; adcurante *Marco Mappo*, M. D. *Argentorati.* 1691. in 12°.

n.245.p.385 21. *Hiſtoire* des *Plantes* qui Naiſſent aux environs de *Paris*: avec leur *Uſage* dans la *Medicine*; per M. *Pitton Tournefort*, M. D. a *Paris* 1698. *in* 8°.

n.265.p.651 22. *Flora Noribergenſis*, *&c.* Being a Catalogue of ſuch Plants as not only grow *Spontaneouſly* about *Nuremburg*, but alſo of ſuch *Exoticks* as the Phyſick Garden of that City hath lately Raiſed; with the Figures and Deſcriptions of many of the moſt Rare, by *Jo. George Volkamer*, M. D. 1700. in 4to.

n.81.p.4027 23 *Plantarum Umbelliferarum Diſtributio Nova* per Tabulas Cognationis & Affinitatis, ex Libro Naturæ Obſervata & Detecta; a *Rob. Moriſon*, Med. & *Prof. Bot. Regio*, *&c. Oxonii*, 1672.

n.74.p.2235 24. De *Abſynthio* Analecta, per *John Michael Febr.* M. D. *Lipſia*, 1668. in 8°.

n.94.p 2236 25. *Crocologia*, Auth. *Joh. Ferdinando Hertodt.* M D. *Jena.* 1671. in 8°.

n.125.p 626 26. *Cochlearia Curioſa*, or the Curioſities of *Scurvygraſs*; written in *Latin* by Dr. *Andr. Molimbrochius* of *Leipſig*, and *Engliſh'd* by Dr. *Tho. Sherly. Lond.* 1678. in 8°.

n.167.p.870 27. *Joh. Nicholai Pechlini.* M. D. *Theophilus Bibaculus*; ſive de *Potu Thea* Dialogus *Franc.* 1684. in 4to.

n.211 p.150 28. Epiſtola de *Generatione Plantarum* ex *Seminibus*, a *Joſepho de Aromatariis. Frankf.* 1625.

n.78.p.3037 29. The *Anatomy* of *Vegetables* begun: with a general Account of *Vegetation* founded thereon, by *Neh. Grew.* M. D. F. R. S. *London.* 1671. in 12*mo.*

n.97 p.6138 30. An Idea of a *Phytological Hiſtory* propounded, together with a Continuation of the *Anatomy* of *Vegetables*, particularly proſecuted upon Roots, and an Account of the *Vegetation* of *Roots*, grounded chiefly thereupon; by *Neh. Grew*, M. D. & F. R. S. *Lond* 1673. in 8°.

n.120.p.486 31. The *Comparative Anatomy* of the Trunks of Plants; together with an Account of their *Vegetation* grounded thereupon, by *Neh. Grew.* M. D. in *vo.*

32. The *Anatomy* of Plants, with a *Idea* of a *Philoſophical Hiſtory* of Plants: n.150,p.363
and ſeveral other Lectures, read before the *R. Society*; by *Neh. Grew*, M. D. 1682.

33. *Marcelli Malpighii Anatome Plantarum*; cui ſubjungitur Appendix, n.117,p.406 Ph. Col. n.1, p. 38
iteratas & auctas ejuſdem de *Ovo Incubato* Obſervationes continens. *Lond.* 1675 & 1679 in *Fol.*

34. The *Poſthumous Works* of S. *Malpighi*. In this Account of them, S. n.226,p.320
Jean Marie Lanciſi gives an *Encomium* and *Character* of the *Author*.

35. *Marcelli Malpighii* Philoſophi & Medici *Bononienſis*, e *Regia Soc. Lond.* n.228,p.545
Opera Poſthuma: Fig. Æneis illuſtrata; quibus præfixa eſt *Ejuſdem Vita*, a Seipſo ſcripta. *Lond.* 1697 in *Fol.*

36. A Philoſophical Diſcourſe of *Earth*, relating to the *Improvement* of n.119,p.454
it for *Vegetation* and the *Propagation* of *Plants*; by *J. Evelyn*, Eſq; *Lond.* 1676. in 8*vo*.

37. The Epitome of the whole Art of *Husbandry*: with Additions of n.114,p.320
New Experiments thereto belonging; *Written* by *J. B. Lond.* 1675. in 8*vo*:

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39. *Sylva & Pomona*; by *E. Evelyn*. Eſq; *Lond.* 1669. in *Fol.*

40. Dr. *Richard Sharrook's Hiſtory* of the *Propagation* and *Improvement* n.82, p.398 n.93,p.1072 n.84,p.5008
of *Vegetables*, by the Concurrence of Art and Nature. *Oxon.* 1672. in 8*vo*.

41. A ſhort and ſure Guide in the Practice of Raiſing and Ordering n.96,p.5049
of *Fruit Trees*; by *Fran. Drope*. B. D. *Oxon.* 1672.

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Fruits now growing in *England*; with particular Rules, how to advance their Nature and Growth as well in Seeds and Herbs, as in ordering of *Trees*; by Sir *Hugh Platt*, in 8*vo*.

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e Preſent Obſtruction removed, and probable Expedients for the better Progreſs; propoſed, for the General Benefit of his Majeſty's Dominions, nd more particularly *Cambridgſhire*, the *Champain Countries*, and *Northern* rts of *England*: In ſeveral Letters out of the Country; by Dr. *J. Beal*, Mr. *Anth. Lawrence*.

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Trees for Preſerving us in Health, or for Curing us when we are Sick. nſlated from the *French*, *Lond.* 1684. 4*to*.

6. The *Engliſh Vineyard* Vindicated; by Mr. *J. Roſe*. n.15,p.62

n.126.p.646 47. The *French Gardiner*, Reprinted: To which is annexed the *English Vineyard Vindicated*, and the way of Making and Ordering Wines in *France*, in 8*vo*.

n.93.p.6019 48. *Vini Rhenani* imprimis *Baccaracenſis*, Anatomia Chymica, a *Joh. Davide Portzio* Phil. & Med. D. *Heidelbergæ*. 1672. in 12*vo*.

n.69.p.2116 49. Joh. Henr. Meibomii de Cerevisiis, Potibuſque & Ebriaminibus extra Vinum aliis Commentarius, annexo Libello Turnebi de Vino. Helmeſtadii. 1668. in 4*to*

n.129.p.574 n.113.p 352 50. *Vinetum Britannicum*: Or a Treatiſe of *Cyder*, and ſuch other *Wines* and *Drinks*, as are extracted from all manner of *Fruits*, growing in this Kingdom: With the Method of *Propagating* all *Vinous Fruit Trees*; and a Deſcription of a New Invented *Ingenio* or *Mill*, for the more Expeditious and better making of *Cyder*. Alſo the Method of making *Metheglin*, and *Birch Wine*. With Copper Plates, by *J. W.* (Author of *Syſtema Agriculturæ*) in 8*vo*. *Advertiſements on this Book are here added by Dr.* Beale.

n.124 p.583 n.126.p.644 51 The Manner of *Raiſing*, *Ordering* and *Improving Foreſt Trees*: Alſo how to *Plant*, *Make* and *Keep*, *Woods*, *Walks Avenues*, *Lawns*, *Hedges*, &c. With ſeveral Figures proper for *Avenues* and *Walks*, to end in; and Convenient Figures for *Lawns*; Alſo Rules and Tables ſhewing how the Ingenious Planter may Meaſure Superficial Figures; with Rules how to divide Woods and Land; and how to Meaſure *Timber* and other Solid Bodies, either by *Arithmetick*, or *Geometry*, &c. by Mr. *Cook*, in 4*to*.

CHAP. VI.

Zoology.

Obſervations in the Ordering of Silk worms; By Mr Edward Digges, n. 2. p. 26

I. 1. I Have kept Leaves 24 Hours after they were gathered, and flung *Water* upon them to keep them from *Withering*: Yet when (without *Wiping* the *Leaves*) I Fed the *Silk Worms*, I obſerved they did as well as thoſe Freſh Gathered.

2. I never obſerved that the ſmell of *Tobacco*, or other Smells that are Rank, did any ways Annoy the *Worm*.

3. Our Country of *Virginia* is very much Subject to *Thunders*: And it hath *Thundred* exceedingly when I have had Worms of all Sorts; ſome *Newly Hatched*; ſome Half way in their Feeding; others Spinning their *Silk*; yet I found none of them concern'd in the *Thunder*, but kept to their Buſineſs as if there had been no ſuch thing.

4. I have made many bottoms of the Brooms (wherein hundreds of Worms Spun) of *Holly*; and the Prickles were ſo far from Hurting them, that even from thoſe Prickles they firſt began to make their *bottoms*.

The Nature and Qualities of Silk; By Mr. Will. Aglionby, n. 152. p. 183.

II. Silk, which is the Spittle of a Worm, hath its good or bad Quality from the Nouriſhment the Worm Receives either from a Good or Bad Leaf. When the Spring proves delightful and ſweet, the Worm feeding on a good and tender Leaf, free from the Prejudices of an unkind Seaſon, (which ſometimes ſpoils the Leaf, by giving it a rough, groſs, and heavy Nature) then one may expect a Profitable Harveſt; and in ſuch Years 'tis beſt to make a good Proviſion, for Silk will then find good Sale when moſt Abundance, and the Buyer meets with that of a good Subſtance with the Advantageous Seaſon very much Contributes to; but not knowing how long it may laſt, about Midſummer (or St. *Johns-Tide*) they begin, in *Piedmont* to draw the *Silk* from its *Coton*, to ſee what it yields, and Judge of its Increaſe or Scarcity, as well as the Eſtimate of its Goodneſs and Perfections; thoſe moſt Deſireable are, that it proves clean, light, and ſtrong.

In caſe the *Seaſon* ſhould not prove Plentiful, then they buy as faſt as they can *Old Silk*, and keep as much as they can of the other, for the beſt Fabricks; that ſo they may not be obliged to Hazard all their Good, at the price of the worſt; which is commonly practiſed: But if the *Seaſon* promiſes a great and ſatisfactory Harveſt, they take the New, and put it apart for the beſt Fabrick; not deſpiſing the old, but only laying it aſide till Proof be made whether the New be better or not.

To know the Silk.

The goodneſs of *Silk* is diſtinguiſhed by its Lightneſs, as the moſt Eſſential Quality; which every Body knows carries a Conſiderable Profit along with it, when Bought by Weight, and ſold by the Yard or Aune. It is to be noted, that the *Organcine* is *Superfine*, it being the beſt ſort, and No. That the two Threads are equal in Fineneſs, that is to ſay, both alike in ſmoothneſs, thickneſs and length, for the Thread of the firſt Twiſt: For the ſecond, it matters not whether the ſingle Thread be ſtrong before the two are Joyned, unleſs to ſee whether the firſt Twiſt prove well. It is neceſſary the *Silk* be Clean, the *Straw Colour* is commonly the lighteſt, and the White the Heavieſt of all. It is likewiſe Convenient, that the *Skeans* be even, and all of an Equality, which ſhows they were Wrought together; otherwiſe with great Reaſon one may ſuſpect that it is *Refuſe Silk*, and cannot be equally Drawn out and Spun; for one Thread will be ſhorter than the other, which is Labour and loſs. It will be alſo Requiſite to ſearch the Bale more than once, and take from out of the Parcels a *Skean* to make an *Eſſay*; for unleſs one Buys that which one knows by Tryal, there is a Hazard of being Cheated, and ſo for one ſort have another.

To Eſtimate by Eſſay.

To Eſtimate the *Silk* by *Eſſay*, fix the *Eſſay* upon one eighth of a *Portee* hand of *Silk*, of 110 *Aunes* of *Lyons* in length, and ſee what it makes of *Aunes* by the eighth Part, the *Skean* which is of 80 Threads, muſt be Multiplied by 110. which is the Length of the 110. *Aunes*, from which Number muſt be deducted one eighth; as for Example, 110 by 80. makes 8800. the eighth Part of which is 1100 which is the eighth Part of a *Portee*. Now to Calculate what theſe 1100 *Aunes* weigh, which is the eighth Part of a *Portee*, or of 110 *Aunes* of *Lyons*, it will be proper to take a *Skean* out of the Parcels, which you take from out of the Bale, which you judge may contain at leaſt 1100 *Aunes*, to make the one eighth Part of a *Portee*; which *Portee* muſt be divided on 2 Bobbins half on each, then fix the 2 Bobbins on the *Cantre (Beam,)* and from thence paſs it through the *(Combe) Heurdiſſoir*; this done, you cut off your *Silk* and weigh it, and Multiply the Weight by eight, it will weigh juſt as much as a *Portee* of 110 *Aunes* of *Lyons*: Which is the general Rule of Calculating, when they draw the *Silk* out. By this means one may learn to adjuſt the weight. There are *Silks* of *Piedmont* which are very light and clean, and to be preferred before any in *Sale*. The *Portee* of *Silk* of the lighteſt weighs near 24 *Penny Weight*, to 25 and 26. Others 27 and 28 which *Weight* may be diſpenſed with, on Condition the other Qualities be as good, to wit, well wrought, even, fine and clean, but above theſe *Weights* they cannot be, unleſs they abate of their Profit, proportionable to what they want in lightneſs.

The Connaught Worm; By Mr. Will. Molyneux. n. 168. p. 876.

III. The *Connaught Worm*, which I find in *Godartius* of *Inſects* deſcribed by the Name of the *Elephant Caterpillar*, is reported to be the only Poyſonous Animal in the Kingdom of *Ireland*. One of them was ſent alive to me from the Country, about 40 Miles from *Dublin*: The Gentleman that ſent it, had kept it above 6 Weeks in a large Box on a Graſſy Sod, now and then giving it a freſh *Sod*, and *Ragwort* to Eat, beſprinkling them with Dew. Some of theſe Worms are as thick as a Man's Thumb, and above 3 Inches long; and ſome Live ſo long, as to have fine Hair, thinly diſperſed over their Bodies.

The Ingenious Gentleman who ſent it me is of Opinion, that the Animal is indeed Pernicious, if eaten by a Beaſt. For firſt, the Diſeaſe, imputed to this Creature, ſeldom or never affects the Cattle but in *Autumn*, and then, only this Inſect is to be found; *Secondly*, it ſeldom or never attends any Cattle but what feed in low Marſhy Grounds, and there only this Animal frequents; *Thirdly*, Cows who are greedy feeders by great Morſels (by reaſon of their Chewing it afterwards in their Cud) but eſpecially *Swine* that feed in low Grounds, are the only Creatures troubled by this Worm; *Fourthly*, the Worm is very rare, and ſcarce to be found in 7 Years, and ſo likewiſe is the Diſtemper that proceeds from it; being rare to have a Beaſt affected by it. As to the *Symptoms* that attend its *Venom*, they are ſwelling in the Head, and (as a Peculiar *Characteriſtick*) the *Swelling* and *Procidentia Ani*, in ſo much that the *Rectum* will hang out above half a Foot. The Effectual Cure applyed to this Malady in *Black Cattle*, is a *Drench* of the Herb *Bears-Foot*, *Rue*, *Garlick*, *Butter* and *Beer*; but for *Swine*, *Raddle* pounded ſmall mingled with *Butter-milk*. Theſe only are uſed by the *Engliſh* Husbandmen. But the *Iriſh*, as they certainly impute the Malady to this *Inſect*, ſo they draw the Remedy therefrom: For they aſſert, that if a Hole be bored in a Tree, and this Creature ſtopt up therein, ſo as to ſtarve and dye, the Leaves and Bark of that Tree, ever after, infuſed in Water, and given as a *Drench*, Cures the affected Beaſt; and ſeveral will repair to ſuch a *Tree*, 10 Miles for a Cure. Another Fancy (and as ill grounded) they have, that if a Man Bruiſe this

Worm between his Hands, and let the Expreſſed Juice dry thereon, ever after the Water he firſt Waſhes in in the Morning, given to the Beaſt to Drink, Cures it.

But I am very apt to ſuſpect, That this Worm is no more Poyſon than other *Caterpillars*. But the Uglineſs of the *Worm* (it being of a Dark, Fuſcous, and as they ſay, Poiſonous Colour,) together with its largeneſs beyond Common *Caterpillars*, has wrought ſo upon the fearful and Ignorant Vulgar People, that they have given it the Name of *Venomous*. Yet I will not conceal, what I have from another Gentleman, (but with ſome Diffidence of the Experiment) he gave the Juice of one of theſe *Worms* to one *Dog*, which ſhewed no Alteration thereon, but another *Dog*, to whom he gave the Skin of the Creature, was found Dead 3 Days after.

But whether his Death proceeded from the Poyſonous Skin, he could not aſſert, for the *Dog* ran at Liberty, and might have been kill'd (for ought as he knew) by ſome other Accident; tho' no External Sign of any Violence offered to him did appear.

AB. is the *Worm*, lying on its Belly, long 2¼ Inches almoſt, *c.* his Head, *dd.* two *Variegated Spots*, miſtaken by the People of our Country for *Eyes*; *e.* a ſmall Protuberance towards its Tail, from whence ariſes a part in ſhape of a Horn, miſtaken for a Sting. *Fig.* 181.

Fig. 182 Repreſents the *Worm* reclined almoſt on his Back, *F.* his Mouth formed like that of other *Caterpillars*, as it appeared in the *Microſcope*, *ggg.* Six ſmall *Horny Feet* or *Claws*, three on each ſide, as in other *Caterpillars*; *hh. Eight Papillæ*, with which he faſtens himſelf to what he goes or hangs on, as Childrens *Suckers* are faſtened to *Wet Stones*. *ii.* two larger *Papillæ*, with which he does both Suck himſelf faſt, and moſt commonly therewith, he graſps the *Stems* of *Graſs* and *Herbs*, to which he clings with the other. *Fig.* 182.

IV. The Bearers of Fruit-Trees are full of Aſperities, and not ſo ſmooth in their Bark as the other Parts of the Tree. If after the Harveſt, and any Time all the Winter over, you look upon theſe Bearers, through an ordinary *Microſcope*, you will find the *Cavities* there full of *Eggs*, of an Oblong Figure, and *Citron Colour*, eſpecially in thoſe Years and Trees, wherein the *Caterpillars* have been numerous: Out of theſe they are Hatcht in the Spring. The Seaſons which uſually deſtroy them are, when there comes an early Heat, ſuch as is ſufficient to Hatch them, before the coming forth of the Buds and Bloſſoms, and when immediately there ſucceeds a Nipping Froſty Air, which ſoon kills them.

The True Origin of Caterpillers, By Dr. Geo. Garden. n. 237. p. 54.

The Diſcovery of this Manner of their *Propagation*, ſeems to give light o theſe Conjectures. 1. That we ought not to conclude, that any *Inſects* re Bred of Corruption, and not *Ex Ovo*, becauſe we cannot diſcern the paricular manner of their *Propagation*: For, the diſcovery of this, you ſee, is by ccident, and not diſcernible by the naked *Eye*. 2. That the *Female Inſects* f all kinds of *Flies* and *Butterflies* do probably put their *Spawn* near thoſe aces where the *Eruca*'s, which are Hatcht of them, are to have their Food:

The Generation of Inſects

Vid Inf. §. IX.

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So that they are to be ſearched for in ſuch Places, by thoſe who enquire into the Manner of their *Propagation*. 3. They ſeem to be fixed into the Cavities of the *Bearers* by a *Gluten*, ſo as that Rains do not Waſh them off. 4. The greateſt *Froſts*, it ſeems do no Hurt to the ſmall *Eggs* of *Inſects*; for I have ſeen the *Caterpillars Hatch*, after moſt *Cold* and *Froſty Winters*, of thoſe *Eggs* which I have obſerved on the *Bearers* all the *Winter* over.

Obſervations on a Glow-worm, By Mr. J. Templer. n. 72. p. 2177. VI. *May*. 27. 1671. I put a *Glow-Worm* into a ſmall thin Box (ſuch as *Pills* are ſent in,) between 11 and 12 at Night, I ſaw her Shine, through the Box, very clearly on one ſide, the Box ſhut; putting *white Paper* into the *Box*, and the *Worm* into the *Paper*, it *ſhined* through the *Paper* and *Box* both.

28. In the Morning about 8 of the Clock, ſhe ſeemed *Dead*, and holding her in a very dark place, I could perceive but very little Light, and that only when ſhe was turned upon her Back, and by Conſequence put into ſome little *Voluntary Motion*. After Sun-ſet that Night, ſhe Walked Briskly up and down in her Box, ſhining as clearly as the Night before; and that, when there was ſo much Day Light, that I could Read without a Candle.

29. In the Morning ſhe ſeemed Dead again; at Night Recovered her ſelf, and ſhined as well as ever, through the Box, and holding a large Candle in my Hand, the Light of it did not ſenſibly diminiſh that of the *Glow-Worm*.

30. 10. *h. v.* I ſet the Box with the *Worm* in it, about 4 Years from me, in a Window, where I perceiv'd it ſhine through the Box, for almoſt an Hour.

31. 4. *h. m.* I found it ſhining, and obſerved it in plain Day Light, for about ½ an Hour, and then wholly ceaſing. At 5 in the *Evening*, the *Worm ſhined* pretty Clear, in a very lightſome Room; at which time the Sun ſhined glorioſly into the Room. Some time after ſhe ſhined little, having contracted her Body into a bending Poſture, the Light ſcarcely ſo big as a great Pin's Head: But upon touching of her, ſhe extended her ſelf, walked in her Box, and at firſt extent ſhined as glorioſly as ever.

N. B. I never ſaw her Shine without ſome Senſible Motion, either in her Body or Legs, in her Cleareſt Shining ſhe extends her Body a third part beyond its uſual Length; and, if my Senſes fail me not, ſhe emits a Senſible Heat in her Clear Shining.

n. 78. p. 3035. *Jun.* 1. Upon ſeveral Tryals of Different Poſitions, I find her not to Shine ſometimes when in Motion: But I could never yet, ſee her Shine, when not in Motion of ſome part.

Jun. 8. Putting her into an *Urinal* of *White Glaſs*, at 9 a Clock at Night, ſhe Crawled Nimbly in it, and extended her ſelf beyond an Ordinary Length, yet her Shining was not ſo Clear, as in her Box when opened. Putting the *Urinal* into the *Water* for about ½ an Hour, it gave a very delightful *Irradiation* of the *Water*. When this Light ſeemed wholly *Extinct*, althou it was in Motion, if I depreſſed the *Urinal* into the Water, till the *Bottom* almoſt touched the *bottom* of the *Baſon*, I could (upon looking in at the top of the *Urinal*) ſee a very fair Light; but upon lifting the *Glaſs* out of the *Water*, I could diſcern very little *ſhining*. Then puting her into her Box, ſhe did in about a Minutes time, for I tryed it twice over, by a Watch, almoſt 10 times increaſe her former *ſhining* in the *Urinal*.

14. The *Worm* ſeem'd *Dead*, and being ſhut in a Box, would give no Light, though it was betwixt 9 and 12 a Clock at Night: But in the uncovered Box, or in the *Urinal*, ſhe did *ſhine faintly*, and the *Light* was of a far different Colour from what it was formerly.

15. I touched her with a Needle gently, whereupon ſhe ſtretched out one of her Legs, and by it, when I inclined the Poſition of the Box, ſhe ſtayed her whole Body from falling. Before I Prick'd her, ſhe did give a little ſhining in her uncovered Box, but none through the *Urinal*: Only if you looked in at Top, a *little ſhining* was ſeen: Upon Pricking her, I did not ſee her *ſhining* encreaſed.

16. I diſcerned a *little ſhining* only within her Box: Upon Pricking I could diſcern no Motion in her; but the Scale next her Tail, was ſenſibly more extended a ¼ of an Hour after I pricked her than before.

NB Theſe laſt 3 Days, ſhe lay continually upon her Back with her Legs contracted except only the time mentioned *June* 15. of my pricking her. I am afraid to conclude her Dead, *June* 16, having been informed by Mr. *Th. Hallebeck* of *Cald-Newton* near *Melton Mawbury*, that he kept a *Glow-Worm* near 6 Months in his Parlour Window, which would ſometimes ſeem Dead for many Days together (if I miſtake not, he ſaid Weeks) and afterwards both Walk and Shine again.

The Flying Glow-worm *By* Mr. Rich. Waller. n. 176. p. 841

VI. The *Cicindela Volans*, or *Flying-Glow-Worm*, is very rare in *England*, yet I have happened to catch of them twice at *Northaw* in *Hertfordſhire*: Firſt about *Midſummer* 1680, and for a Fortnight in *June* 1684. They flew about the Candle as ſoon as it grew dark; at both which times, the Weather was very Hot, and it may be it *ſhines* only at ſuch Seaſons, tho' the Animal be eaſie enough to be met withal Winged, when it ſhines not, and without Wings ſhining, which is the Common *Glow worm*.

Lib. 4. c. 8. c. 15 p 108. *De Luce Animalium.* Lib. 2. c. 12.

The Deſcription of it by *Aldrovandus* agrees very well with the Animal: But both *Mouſet* and *Tho. Bartholin* are miſtaken, in allowing the Male only to have Wings. The contrary was known to *Julius Scaliger*: And I once Caught the Male and Female Coupled, and could obſerve no difference between them, except in Size, (the Female being a little the larger) for they both *ſhined* alike. It's Light was very *Vivid*, ſo as to be ſeen plainly when a Candle was in the Room; but the *Vibrations* thereof were unequal, and the Colour *Greeniſh*, like that of the *Creeping Glow-worm*. The *Luminous Part* was two ſmall Specks on the underſide of the Tail, at its End. The *ſhining* continued for a little while after the *Tail* was cut off, tho' it ſenſibly decayed, till at laſt it went quite out. Poſſibly, the uſe of this Light is, to be a *Lanthorn* to the *Inſect* in catching its Prey; and to direct its Courſe by, in the Night: Which is made probable, by the *Poſition* of it on the under Part of the *Tail*, ſo that by bending the ſame downward (as I always obſerved it to do) it gives a Light forward upon the Prey or Objects, the *Luminous Rays*, in the mean time, not being at all incommodious to its Sight, as they would have been, if this *Torch* had been carried before it. This Conjecture is alſo favoured by the placing of the *Eyes*, which are on the under Part of the Head, not on the *Top*. I obſerved alſo, that it could, and did, by ſome Contrivance, cover its Light, and make a kind of *Dark Lanthorn*.

Fig.183. *Fig.* 183. ſhews the *Inſect* upon its Feet, with the Back upwards; where it appears to be of the *Beetle* kind. It is of a Dark-brown Colour, unpoliſh'd: when the *Caſe-wings* are opened, it extends two very large *Membranous Wings*, faſtened to the upper part of the *Thorax*. It's Head is covered, as it were, with a Shield, or Broad-brimm'd Hat.

Fig.184. *Fig.* 184. Repreſents it laid on the Back, to ſhew the two Eyes under the broad Covering. They are Black, and very large, making almoſt the whole Head; there being little elſe to be ſeen. Theſe are Moveable, ſo that the *Animal* can thruſt them forward to the Edge of its Hat. From between theſe, are diſcovered the 2 Hairy Feelers, or perhaps Bruſhes to Cleanſe the *Eyes*. Between theſe *Eyes* and the *Thorax* lies the Mouth. On the *Thorax* are 6 Legs, almoſt all of a length. The *Tail* is made of Seven Shelly Rings; at the laſt of which are Viſible, the two *Shining Points*.

Fig.185. *Fig.* 185. Shews the *Inſect* on its Back, as it was ſeen through a *Microſcope* when Dead; where *A A*. Repreſents the two long Horns, Feelers, or Bruſhes, conſiſting of ten Roundiſh Joints, beſides the firſt, which is as long as two of the reſt; they are all Hairy, and like thoſe of ſome *Butter-flies*; for all have them not. *B B*. The Broad Covering, or Hat, over the Head, which ſhewed of a Speckled Brown, and Yellowiſh Colour, like *Tortois-ſhell*. *C C*. The two *Eyes* compoſed of Innumerable ſmall *Glaſſy Hemiſpheres* in *Rows*; as hath been obſerved by the Ingenious Mr. *Hook*, in his *Micography*, to be the make of *Inſects Eyes*, ſo to ſupply the Defect of Motion in their *Eyes* by the Number of *Pupilla*'s. I have ſeen theſe Spherical Bodies in the *Eyes* of ſome *Butter-flies*, ſet in Circles not Rows; with long Hairs growing out of each ſpace, left by the Connexion of three *Hemiſpheres*. *DDDDDD*. The Legs of a Shelly-make like *Lobſters*, and ſo Jointed. As well in this as other *Flies*, they are covered with many Stiff Hairs, tho' not ſo full as thoſe of the Blue-Fly, Figured by Mr. *Hook*. Microg.Sch. 26. The *Mechaniſm* of the Feet, as I take it, are much the ſame; only what is there call'd the *Pattens*, were here wanting (if not broken off, as I believe they were not,) and their uſe ſupplyed by the *Gibbous* Part, Repreſented by *d d d*. The *Talons e e e e e e*. of the Feet were ſhining, and very Sharp Pointed. The Legs were of two long Joints, and the Feet of 4 more, beſides that which was Armed with the *Talons*. Theſe ſeemed to be Joynted one into Another, and were all thick beſet with Hairs, or Briſtles. E. The *Thorax* of but one Shell, of a Poliſh'd *Copper Colour*

ſtuck full of *Tapering Briſtles*, a ſmall dent being diſcernable in the Shell wherein each grew. F. the *Tale*, conſiſting of 7 Rings of the ſame browniſh Colour; without Hairs except on their Edges, which were ſet with them like a thin Fringe, as the Tails of *Lobſters*, &c. are. Theſe Rings were of an unequal ſhining Shell-Cover, *ff*. The Back or upper Part, of two or three Rings, of the *Tail*, turned up to ſhew the Work of the Shell on that ſide. On the inſide of the Laſt of theſe was the Light placed, tho' there was now nothing to be ſeen, except that part being a little lighter Colour'd than the reſt of the *Tail*. *GGG*. the *Membranous wings*, in every particular like thoſe of the Blue-fly, with Hairs upon the Veins, or Quilly Parts. *HH*. the inſides of the *Caſe-wings*, which were Hairy pointing all dowhward, the outſide of theſe *Caſes* is alſo very Briſtly.

An odd Sort of Maggots; *By Dr.* M. Liſter. n. 160 p. 595:

VII. In the *Harveſt Time*, 1666. the Sickneſs raging then at *Cambridge*, at *Baſſenburn* in *Cambridgſhire* there were Millions of *Maggots* on the *Corn Lands*; and in their Barns too, the Floor would be cover'd with them that fell from the Carts. The *Maggots* were about half an Inch long, no thicker than a *Pigeons Feather*, of a White Colour, ſomewhat ſhaded with an *Iſabella*, or faint Yellowiſh ſtripes, the length of the Worm; they had 14 Feet, after the manner of many *Caterpillars*, and I was almoſt Confident would have produced ſome ſort of *Moth*. I took up about a Score of them, and put them into a Box: but they immediately offended me with an ungrateful and ſtrong Stink, which yet is not uſual to the *Caterpillars kind*. After two Days I rid my ſelf of them, and only obſerv'd, that the *Excrements* which they voided, were little hard *Pellets* of pure white Flower, like that of Barley.

Swarms of Strange *and* Miſchievous *Inſects, in* New England; *By* . . . n. 8. p. 137

VIII. Some few Years ſince there was ſuch a Swarm of a certain ſort of *Inſects* in *New England*, that for the ſpace of 200 Miles they poyſoned and deſtroyed all the *Trees* of the Country, there being found innumerable little Holes in the Ground, out of which thoſe *Inſects* broke forth in the form of *Maggots*, which turned into Flyes that had a kind of *Tail*, or *Sting*, which they ſtuck into the Tree, and thereby Envenomed and Killed it.

The Libella; *By* M Poupart, n. 265. p 673

IX. The *Libella* is a Flying *Inſect*, called in *France*, *Demoiſelle* from the Variety of its Colours, Tranſparency of Wings, and its ſtately Flight. They alſo call it *Pearle*, from the Figure of its Head, or rather from the roundneſs and Colour of its Eyes. It is divided from ſpace to ſpace into Rings, by means of which it compoſes *Angles* with its *Body*, whoſe Lines it can make longer or ſhorter as it finds occaſion.

Theſe different *Sections* ſerve to the Motion of this *Inſect*, as we know the Tail doth in Birds, and as they are Lengthned or Contracted, they carry themſelves according to their Various Inclinations, the Point or Center being fixed between their Wings. All Modern Naturaliſts know the greater ſort of *Libella* are Generated under *Water*, wrapt up in a *Membrane*, which at length diſſolves and turns to nothing.

When the Young *Libella* is ready to quit its Caſe, it *Dilates* its *Belly*, that the *Water* may enter in at the *Anus* upon the *Inteſtines*, then it Compreſſes it ſelf to Circulate the *Water*, which it Expels, and ſhoots out a great way. It receives more *Water* into its *Inteſtines*, and *Ejects* it after the ſame Manner. It continues this Action with great Force for ſome time, and makes the *Water Circulate* in the *Veſſel*.

To ſatisfy my ſelf that it took the *Water* in at the *Anus* and not at the Mouth, I put a *Libella* upon my Finger, which I held faſt by the *Legs*, I dipt it under *Water* with its Head downwards, the *Anus* being even with the *Water*, ſo that it might get into the *Inteſtines* which it caſt out a good way, I drew my Finger a little further out, ſo that the Water could not enter at the *Anus*, and the Fly continued its Motion, but ejected on Water. My Opinion is, ſhe does this in order to Cleanſe her ſelf from all *Excrements* in that Element, where ſhe leaves her old Robes, to appear in a more Glorious and new Form in the Open Air.

There are a great Number of ſmall Veſſels which cloſely Unite the Body of the *Libella* to its Caſe: It is neceſſary that theſe be dry, that they may the ſooner break when it makes its efforts to get out of its Caſe, which cannot come to paſs as long as there is any *Aliment* in the *Inteſtine* to afford Nouriſhment to the Caſe, and its Strings. And perhaps this is the Reaſon, why no *Inſects* will take any Food, when they are going to Change their Forms: And if they do not Cleanſe themſelves, as the *Libella*'s do, yet they ſtay a great while longer, before they Change, without any *Aliment*; the *Libella* is no longer than half a *Day* in quitting its *Caſe*, and taking its Flight.

To know the Cauſe of its exceeding Swift and Whirling Motion, we muſt cut the Skin of the *Libella*, which is very fine, all along the Back, and be ſure to bear the Point of the Scizzars upwards, leſt we cut the Interiour Parts. We muſt alſo draw the Skin to the Right and Left Hand, and fix it with Pins upon a Table, that we may Diſcover the 16 *Muſcles*, which lye between the *Wings* and the *Legs*, (8 on each ſide) of the thickneſs, length, colour, and almoſt Figure or Shape of a Grain of Barley, Contiguous to one another, and without Adherence. We may obſerve that each *Muſcle* is compoſed of many Fleſhy *Fibres*, which do not ſeem to be Joyned together, but Terminate Round at the ends of the *Muſcle* where they compoſe a Common *Tendon*; ſo that one might diſcern any of theſe *Fibres* to be a ſmall *Muſcle*, of which the chief is Compoſed. The uſe of theſe *Muſcles* ſeem to me very Particular: For the ſame *Muſcles* which flutter the *Wings*, ſerve alſo to ſtir the *Legs*. The upper *Tendons* of the *Muſcles* enter into the *Wings*, I believe the ſame which the *Fibres* Compoſe, and the lower enter a good way into the *Legs*; yet the contrary Motions of theſe *Organs* are not at all hindred, for as long as the *Wings* Play, the *Feet* lie ſtill, and ſerve for a Prop to the *Muſcles* which ſtir the *Wings*; and when the *Feet* are in Action, the *Wings* are quiet, and in their Turn ſerve to ſupport the *Tendons* which direct the Feet.

The Eyes are like two thick oblong *Pearls*, which begin at the Fore-part of the *Head*, and end in the hinder Part; their outward *Membrane* is dry, thin, tranſparent, and incloſes a ſmall ſoft Ball, filled with a very *black Liquor*, two ſmall Canals fill'd with Air, enter into each of theſe Eyes, and run along to the great *Channel*, alſo furniſhed with Air; which accompanies the Inteſtine from the Head to the Tail. This *Structure* made me think, that the *Libella* could drive the *Air* contain'd in theſe Canals into the Eyes, to give it a greater Convexity to behold Objects that are very near: And on the contrary, the Air is forced out of the Eyes again to flatten them, when they look at remote Objects. And my Conjecture is not altogether frivolous, for having blown into the thick Canals, which are about the middle of the Body, the Eyes became conſiderably tumified and by letting the Air return they became flat again. If we leave a *Libella*, dead for ſome Days, the internal Parts will putrifie, and come to nothing: But theſe Canals will remain entire, and as ſolid and firm as they were before.

Of ſpontaneous Generation, by Mr. *Ray*, n. 74. p. 2219.

X. Whether there be any *Spontaneous*, or *Anomalous Generation* of *Animals*, as hath been the conſtant Opinion of *Naturaliſts* heretofore, I think there is good Reaſon to queſtion. It ſeems to me at preſent moſt probable, that there is no ſuch thing, but that even all *Inſects* are the natural Iſſue of Parents of the ſame Species with themſelves.

Gener. degl' Inſetti.

Fr. Redi hath gone a good way in proving this; Having cleared the Point concerning Generation *ex Materia Putrida*. But ſtill there remain two great Difficulties; the Firſt is, to give an Account of the Production of *Inſects*, bred in the *By-Fruits* and *Excreſcences* of *Vegetables*, which the ſaid *Redi* doubts not to aſcribe to the Vegetative Soul of the Plant that yields thoſe Excreſcencies; but for this I refer you to Mr. *Liſter*. The ſecond is, to render an Account of *Inſects* bred in the Bodies of other Animals.

The Grain of Kermes, its uſe, and the Fly formed out of it, by M. Verney, n. 20. p. 362.

XI. 1. M. *Verney*, a *French* Apothecary at *Montpelier*, having deſcribed the *Grain* of *Kermes* to be an *Excreſcence* growing upon *Wood*, and often upon the Leaves of a *Shrub*, plentiful in *Languedock*, and gathered in the End of *May*, and the beginning of *June*, full of a red Juice; ſubjoyns two uſes which that Grain hath, the one for Medicine, the other for dying of *Wool*. For the latter uſe, they take the Grain of *Kermes*, when ripe, and ſpread it upon *Linen*, and at firſt, whilſt it abounds moſt in *Moiſture*, 'tis turned twice or thrice a Day, to prevent its Heating; and when there appears red Powder amongſt it, they ſeparate it paſſing it thro' a Searce; and then again they ſpread abroad the Grain upon the Linen, until there be perceiv'd the ſame Redneſs of the Powder; and at the End, this red Powder appears about, and on, the ſurface of the Grain, which is ſtill to be paſſed through a Searce, till it render no more.

In the Beginning, when the ſmall red *Grains* are ſeen to move, as they will do, they are ſprinkled over with *ſtrong Vinegar*, and rub'd between ones *Hands*. If this red *Powder* ſhould be let alone, without pouring *Vinegar*, or ſome other acid Liquor upon it, out of every Grain there would be formed a little *Fly*, which would skip and fly up and down for a Day or two, and at *laſt* changing its Colour, fall down quite dead, deprived of all the Bitterneſs, the Grain, whence they are generated, had before.

The *Grain* being altogether emptied of its Pulp *or red Powder*, 'tis waſh'd in Wine, and then expoſed to the Sun; being well dryed, 'tis Rubb'd in a Sack to render it bright, and then 'tis put up in ſmall *Sacks*, putting in the midſt, according to the Quantity the *Grain* has afforded, 10 or 12 Pounds (for a *Quintal*) of the Duſt, which is the red Powder, that came out of it. And accordingly, as the Grain affords more or leſs of the ſaid Powder, *Dyers* buy or leſs of it.

'Tis to be noted, that the firſt red Powder which appears, iſſues out of the Hole of the *Grain*, that is on the ſide, where the *Grain* adhered to the *Plant*, and that that, which about the end appears ſticking on the *Grain*, hath been alive in the *Husk*, having pierced its Cover tho' the Hole, whence it commonly iſſues, remains cloſe, as to the Eye.

The Inſect Husks of the *Kermes kind*, by *Dr.* M. *Liſter*, n. 71. p. 2165. n. 72. p. 2177.

2. Some Years ago, I gathered off our *Engliſh Oak*, round *Worm-Husks*, very like *Kermes Berries*; and I have often obſerved on *Plumb-trees*, and *Cherry-trees*, alſo on the *Vine*, and *Cherry Laurel*, certain *Patellæ* or flat Husks, containing *Worms*, which, (or at leaſt the Husks) will ſtrike a *Carnation* with *Ly* and *Stand*. In *May* 1671. I obſerved the ſame *Patellæ*, or Husks, indifferently on Vine-branches, Cherry-Laurel, Roſe-Buſhes, Plumb-trees, and the Cherry-tree. The Figure of the Husks is round, ſave where it cleaved to the *Branch*; for *Bigneſs*, ſomewhat more than half a *Gray-pea*: Theſe, I ſay, cleave to their *Branches*, as *Patellæ* do to *Rocks*; for *Colour*, they are of a very dark *Cheſnut*, extreamly ſmooth, and ſhining *Membrane-like*. They adhere moſt commonly to the Underſide of a *Branch*, or *Twig*, and ſo are beſt ſecured againſt the Injuries of the *Weather*; as to much Sun and Rain. They are well *faſten'd* to the *Branches* ſingle, and ſometimes many in Company. They are ſeldom found without *Vermin*, as *Piſmires*, &c. which I gueſs, pierce them, and prey upon them. If you cut off dexterouſly the top of the Husk with a *Razor*, you'll find ſometimes 5 or more ſmall white *Maggots*, of the *Waſp*, or *Bee*-kind, that is, ſharp at both Ends. If when you have cleared the Husk, you rub the empty Membrane upon white Paper, it will freely and copiouſly tinge the Paper with a beautiful Purple, or *Murrey*.

n. 73. p. 2196 n. 76. p. 2294

Jun. 10. 16 1. I found ſeveral of theſe *Patellæ Kermiformes* hatched in a *Box*, where I had purpoſely put them, they prove a ſort of *Bees*, but certainly the leaſt that ever I yet ſaw of that *Tribe*, as not much exceeding in their whole Bulk the half of a Piſmire. They are very compact and thick for the Bigneſs, of a coal-black Colour. There is a remarkable Spot on their *Backs*, white, or ſtraw-colour, large and round. The upper pair of their *Wings* are ſhaded, or dark ſpotted, the undermoſt Pair are clear. We may entitle them, according to our Cuſtom, *Apiculæ Nigra, macula ſuper Humeros ſubfla-*

veſcente inſignita, e patellis ſive Favis membranaceis, veri Kermes, ſimilibus, ſuaque itidem purpura tingentibus, Ceraſi aut Roſæ aliarumve Arborum Virgis adtextis, excluſa.

It is to be further obſerved,

1. That thoſe that look the blackeſt, yield the deepeſt and beſt Purple.

2. That as the *Bees* come to Maturity, the *Dye* ſeems to be ſpent, and the Husks grow dry.

3. That the *Young* Ones make their Way out at ſeveral ſmall *Holes*, that Hole in ſome of the *Shop Kermes*, being accidental only and ever on the bottom part cleaving to the *Branch*, and the Time of gathering them for Colour, is without Doubt before they are pierced, and whilſt the Animal is yet *in Vermiculo*, and conſequently the *Husk* entire.

We compared theſe *Purple Kermes* with the *Scarlet Kermes* or Grains of the Shops, and found them in every Point to agree, ſave in the Colour of their Juices; and particularly, (finding in ſome Parcels of the Shops, many yet ſticking to little Twigs of the *Ilex*) we confidently affirm, that thoſe, as well as ours, are only contiguous to the *Ilex* Branches, and are not *Excreſcencies* of the Tree, much leſs Fruit or Berries, by which abuſive Names they have been too long known; but that they are the Artifice and ſole Work of the *Mother Bee*, in order to the more convenient Hiving and Nouriſhment of her Young.

Theſe things are alſo certain, *viz.*

1. That we have ſeen the very Gum of the *Apricock* and *Cherry Laurel Tree's* tranſudated, at leaſt ſtanding in a Chryſtal Drop upon ſome, though very rarely, of the Tops of theſe Kermes.

2. That they change Colour, from a *yellow* to a *dark brown*, and that they ſeem to be diſtended, and to wax greater, and from ſoft to become brittle.

3. That they are filled with a ſort of *Mites*, concerning which I am pretty well aſſured by my own, and alſo by Dr. *Johnſon* of *Pomfret*'s more accurate *Microſcopical Obſervations.*

4. That the *Bee Grubs* actually feed on Mites; there being no other Food for them.

5. That there are other ſpecies of Bees or Waſps; beſides thoſe by me deſcribed, which are ſometimes found to make theſe Mites their Food: Dr. *Johnſon* having opened one Husk, with only one large Maggot in it.

6. That there are probably different ſorts of *Mites* in theſe Husks making poſſibly different ſpecies of *Kermes*; For ſome I have found to hold *Carnation colour'd Mites* encloſed in a fine white Cotton, the whole Husk ſtarting from the *Twig*, ſhrivelling up and ſerving only for a Cap or Cover to that Company of Mites. Other Mites I have ſeen white, and which is moſt uſual, the Husks continuing entire, and not coming away from the Twig they adhere to, and but little Cotton at the bottom.

7. That the ſhrivell'd Cap, to be found upon the Mites incloſed in the Cotton, as alſo to the whole Husk it ſelf, if taken early in *April*, while ſoft,

will (dried in the Sun) ſhrink into the very Figure of *Cochineel* : Whence we gueſs, that *Cochineel* may be a ſort of Kermes, taken thus early and ſun-dried.

I conceive that the ſmall *Scarlet-powder*, mentioned by Mr. *Verney*, is to be underſtood of thoſe Mites, and that they are to be diſtinguiſh'd from the Bee Grubs, which are changed into the Skipping Fly, that is, the *Bee*, for Kind at leaſt, here deſcribed by us.

Obſervations on vegetable Excreſcencies and Inſects generated in them, by Dr. M. Liſter, n 75. p. 256.

XII. 1. The Account I have given of the *Purple Kermes*, both gives a clear Light to the Diſcovery of the Nature of the *Scarlet Kermes*, a Thing wholly unknown to the *Ancients*, and alſo is an evident inſtance, that ſome Things confidently believed Vegetable Excreſcencies, are no ſuch matter, but artificial Things, meerly contiguous to the Plant, and which have no other Relation to it, than the *Patella* Shell Fiſh to the Rock it cleaves to.

2. Generally, Inſect Eggs laid upon the Leaves of Plants, or their reſpective Worms feeding on them, do not occaſion or raiſe Excreſcencies. n 76. p. 2284

n. 77. p. 3003 Thus, for Example, the Eggs of the common red *Butterfly*, laid upon the *Nettle*, are thereon hatched without Bliſtering the Plant into an Excreſcence; and the ſtiff haired, or prickly *Catterpillars*, hatched from theſe Eggs, Feed upon the Leaves without any ill Impreſſion, Puncture, or Prejudice; ſave that they make clean Work, and eat all before them.

3. Some *Inſect* Eggs laid upon the Leaves or other part of Plants, do as ſoon as hatched, pierce and enter within the Plant to feed. I had a convincing inſtance to the Truth of this Propoſition.

May 22. 1671. When I obſerv'd on the Back or Underſide of the Leaves of *Atriplex Olida*, certain ſmall milk-white oblong Eggs; on ſome Leaves 4, on others fewer, or more. Theſe Eggs were on ſome Plants yet *unhatched*, but on many of the ſame Plants I found the Egg-ſhells or Skins yet adhering to the Leaves, and the little Maggots already entered, thro' I know not what inviſible Holes, within the 2 Membranes of the Leaf, and feeding on the *inward pulp* or *ſubſtance* of the *Leaf*; in other Leaves of that Plant I found thoſe Magoots grown very great, and yet the two Membranes, that is, the uppermoſt and undermoſt Skin of the Leaf entire, but raiſed and hollow like a *Bladder*. *Note*, 1. That thoſe Maggots were of a *Conick ſhape*. 2. That in *July* they ſhrunk into *Fly Chryſali's*, and accordingly came to Perfection; And to this unobvious Way of Feeding we think we may Refer all worm Eaten Fruits, Woods, &c.

4. *Worms Feeding* within ſome of the Parts of ſome Plants, do cauſe Excreſcencies; Thus the Heads or Seed Veſſels of *Papaver. Spart. Sylv. Ger. Emac.* &c are disfigured for having Worms in them, and grow thrice as big as the not ſeiſed ones. This is alſo plain in the Excreſcences of *Pſeudo-Teucrium* and *Barbarea*.

5. The Subſtance or Fibrous Part, of many vegetable Excreſcencies ſeems not to be the *Food* of the Worms found in them; that is, the Worms in thoſe vegetable Excreſcencies which produce *Ichneumons*, (to which kind of *Inſect* we would limit this Propoſition) do not ſeem to devour the Subſtance or

Fibrous part of them, as other Worms eat the Kernels of *Nuts*, &c. but whatever their manner of *Feeding* is, (and we doubt not but they are nouriſh'd in and upon ſome part of them) the *Vegetable Excreſcencies* ſtill mightily increaſe in Bulk, and riſe as the Worms feed. And it is obſervable (to endeavour a Solution) that ſome of the *Ichneumons* Delight to feed on a liquid Matter, as the Eggs of *Spiders*, and the *Juices*, if not *Eggs*, within the Bodies of *Caterpillars* and *Maggots*. Whence we conjecture, that thoſe of the ſame Genus, to be found in *Vegetable Excreſcencies*, may in like manner ſuck in the Juices of the equivalent Parts of Vegetables. And this the dry and *ſpongy Texture* of ſome of thoſe Kinds of Excreſcencies ſeem to evince. For if you cut in Pieces a wild *Poppy Head*, for Example, (or the great and ſoft Balls of the *Oak*) you'll find in thoſe *Partitions*, wherein theſe Worms are lodged, nothing but a pithy Subſtance like that of young Elder; and if there chance to be any *Cells* yet unſeiſed, which I have ſometimes obſerved, the Seeds therein will be found yet entire and ripe; whence 'tis very probable that they feed upon, or ſuck in by little and little, the yet liquid *Pulp* of the tender Seeds, and leave the Subſtance, or fibrous Part to be expanded into an *Excreſcence*.

Vid. inf. §. XIV.

The Gall-Bee, by Mr. Ben. Allen, n. 245. p. 375.

XIII. In ſome *Aleppo Galls*, which the Inſects had not eat their Way out of, I found a ſort of *Bee* reſembling the ſmall ſort of our *wild Bees* which *Earth*, they have long Wings, a deep Belly, and on the Back, near the Commiſure to the Body, it is of a *greeniſh Black*, the reſt *reddiſh*, near a *Cinnamon Colour*.

Theſe *Galls* are very gummy, and the *Cavity* round them was ſo extreamly *gummy*, that not the leaſt Room or Entrance of it appeared, tho' the *Bee* was beginning to make its Way out. Some of the *Galls* had a *Stem* to them, and may give ſome Light to the Reaſon of Life, that the *Atmoſpherical Air* is not neceſſary to the Eſſence, before the Organs of the Body are employ'd; but that that is maintained by a ſubtiler Air, that pervades more minute Pores, as it is conveyed to fiſh thro' the Water.

I have alſo found in the grayer ſort of *Galls*, not ſo rich in *Gum*, a ſmall *Ichneumon* of a bright *Green*.

Ichneumonide Waſps, and the manner of laying their Eggs in the bodies of *Caterpillars*, by Mr. Fr. Willoughby, n. 76. p. 2279.

XIV. 1. As I remember, Mr. *Liſter*'s Opinion is, that the *Muſca Ichneumones* lay their Eggs in the Bodies of *Caterpillars*; which I look upon as very ingenious and true. Theſe *Ichneumones* have all 4 *Wings*, *Antennæ* like *Bees*; their Body hanging to their Breaſt by a ſlender Ligament, as in Waſps; moſt if not all, have Stings, and are made of a *Maggot* that ſpins her ſelf a *Theca* before ſhe turns into a *Nympha*. There is great Variety of them, ſome breed as Bees do, laying an *Egg*, which produceth a *Maggot*, which they feed till it comes to its full Growth; others, as we gueſs, thruſt their Eggs into Plants, the Bodies of living *Caterpillars*, *Maggots*, &c. For, it is very ſurprizing to obſerve, that a great *Caterpillar* inſtead of being *changed* into a *Butterfly*, according to the uſual Courſe of *Nature*, ſhould produce ſometimes one, ſometimes 2 or 3, and ſometimes a whole *Swarm* of *Ichneumones*. I have obſerved this *anomalous Production* in a great many ſorts of Caterpillars, both hairy and ſmooth in ſeveral ſorts of *maggots*, and (which is moſt ſtrange, in one *Water Inſect*. When there come many of theſe *Ichneumon* Maggots out of the Body of the ſame *Caterpillar*, they weave all their *Theca*'s together into one *Bunch*, which is ſometimes round, with a *Web* about it, juſt like a Bag of *Spider*'s Eggs. But none of them feed upon Spiders Eggs; but it is the Similitude of thoſe *Theca*'s conglobated together to the Eggs of Spiders, that hath occaſioned that Conjecture

One of the green *Caterpillars* common in the *Heaths* in the *North*, went ſo far on to her *natural Change*, that ſhe made herſelf up into a great brown *Theca*, almoſt of the Shape of a *Bottle*, which was filled with a ſwarm of *ichneumones*, and I have obſerved in 1 or 2 other ſorts, that from the very *Aurelia* itſelf hath come an *Ichneumon*, which is very odd, that the *Caterpillar*, ſtung and impregnated by the *Ichneumons*, ſhould be yet ſo far unhurt and unconcerned, as to make herſelf a *Theca*, and to be turned into an *Aurelia*.

I have often ſeen a great *Ichneumon* dragging a *Caterpillar* in the highway. This Year 1671, Mr. *Wray*, in company with another ingenious *Neighbour*, obſerving one hailing a large *green Caterpillar*, much bigger than herſelf, which after ſhe had drawn the length of a *Pearch*, ſhe laid down, and then takes out a little *Pellet* of *Earth*, with which ſhe had ſtopped the Mouth of a ſmall *Hole*, like a *Worm-hole*, then ſhe goes down into it, and ſtaying a very little comes up again, and draws the *Eruca* down with her into the Hole, and there leaves her, and afterwards not only ſtops but fills up the Hole, ſometimes carrying in little Clods, and ſometimes ſcraping Duſt with her Feet, and throwing it backwards into the *Hole*, going down after it herſelf, to ram it cloſe. Once or twice ſhe flew up into a *Pine-tree*, which grew juſt over her hole, perhaps to fetch *Cement*. When the *Hole* was full and even with the ſuperficies of the Ground about it, ſhe draws 2 *Pine-tree Leaves*, and lays them near the Mouth of the Hole, and flies away. Not taking Notice that ſhe came any more in 3 or 4 Days, we digg'd for the *Caterpillar*, and found it pretty deep. I put it into a Box, expecting it would have produced an *Ichneumon*, but it dried away, and nothing came of it.

We lately obſerved a ſort of *Ichneumons*, or rather *Veſpæ*, which prey upon ſeveral ſorts of *Flies*, when they fly with them, they hold them by the *Heads*, and carry them under their Bellies. Theſe make *Holes* a great depth in the ground, in which they lay their *Young*, and feed 'em with the *Flies* they catch, creeping backwards into the Ground, and drawing the *Flies* after them. I ſuſpect they may at firſt lay their Eggs in the very Body of a *Fly*; but one *Fly* being not enough to bring the young one to its full Growth, they feed it with more. Their *Theca*'s are at laſt all covered over with the *Wings*, *Legs*, and other Fragments of *Flies*.

By Dr. Liſter, ib p. 2281. 2284.

2. This kind of Inſect is one of the greateſt Puzzles in Nature, there being few Excreſcencies of *Plants*, and very many Births of Inſects, wherein theſe ſlender Waſps after divers ſtrange ways are concerned.

'Tis true, the Swarms of theſe *Ichneumons*, coming out of the Sides of *Caterpillars*, do immediately make themſelves up into Bunches, and each particular *Theca*, from the *Cabbage Caterpillar*, (for Example) is wrought about with yellow Silk, as thoſe from the black and yellow *Jacobæa Caterpillar* with *White* : but as for *Web* to cover thoſe Bunches of *Theca*'s, I never obſerved it but in the green *Caterpillars*, ſo common in our *Lincolnſhire Heaths*, which are fixed to Bents or other Plants. Theſe in Truth never but deceived my Expectation, for I verily thought I had found, when I firſt obſerved them, a Caterpillar equivalent to the *Indian Silk-worm*, but having cut them in two, and expected to have found a Caterpillar's *Chryſalis* in the middle there preſented themſelves a Swarm of *Ichneumons*. Theſe are as large, many of them, as my *Thumb*; that is, at leaſt 4 times bigger than the *Folliculus* or *Egg-Bag* of any *Engliſh Spider* I ever ſaw yet. I have had them in ſeveral Boxes, ſome 8, ſome 10, ſome 12 Days in *Vermiculo*, feeding upon the very Cakes of Spiders-Eggs, before they wrought themſelves *Theca*'s for further Change; and they ſeldom exceeded the Number of 5 to one Cake of Eggs, *&c.* So that you may aſſure Mr. *Willoughby*, this is no Conjecture, but a real Obſervation.

Concerning the Name ἰχνεύμων I refer you to Mr. *Ray*, who is another *Heſychius*, and we have Obſervations enough to make us believe, that thoſe very *Inſects* we have here treated of, are for kind, the *Ichneumones* of the Ancients, n.77. p.3005

XV. It hath been credibly reported, that Horſe-hairs thrown into Water will be animated ; and yet I ſhall ſhew you by an unqueſtionable Obſervation, that ſuch things as are vulgarly thought animated Hairs are very Inſects, nourished within the Bodies of other Inſects, even as *Ichneumones* are, within the Bodies of *Caterpillars*. I find many Particulars collected by the Induſtry of *Aldrovandus*, concerning this Inſect : But our own Obſervation is this, Hair worms, by Dr. M. Liſter, n.83. p.4064.

April 2. 1972. There was thrown up out of the Ground of my Garden, a certain coal-black *Beetle* of a middle ſize, and flat ſhape, and which I have obſerved elſewhere common enough. I diſſected ſome of them, and was ſurprized to find in their ſwollen Bellies of theſe *Hair Worms*, in ſome 3. in others but only one. Theſe Particulars we carefully noted.

1. That upon the Inciſion, they crawl'd forth of themſelves.

2. That putting them into Water, they lived in it many Days, and did ſeem to endeavour to eſcape by lifting up their Heads out of the Water, and faſtening them to the Sides of the Veſſels; very plainly drawing the reſt of their Body forward.

3. That they cannot be ſaid to be *Amphisbæna*, but do move forward only by the Head, which is fairly diſtinguiſhable from the Tail by a notable Blackneſs.

4. That the 3. I took out of the Body of one *Beetle*, were all of a dark Hair Colour with whitiſh Bellies, ſomewhat thicker than *Hogs Briſtles*, but I took out of the Body of another *Beetle*, one that was much thicker than the reſt, much lighter coloured, and by Meaſure juſt $5\frac{1}{2}$ Inches long, whereas all the reſt did not exceed $3\frac{3}{4}$ Inches.

Some Obſervations about *Bees*, by Dr. George Garden, n. 175. p. 1157.

XVI. M. *Leewenhoek*, in 1673. took notice of 5 little *Inſtruments*, which are on the Head of the *Bee* before: 4 whereof are two Pairs, the one being called by him *Scrapers*, the other *Arms*, the fifth he calls the *Wiper*, ſuppoſing that by it they wipe off the Honey from the Flowers. This laſt is truly the *Sucker* or *Proboſcis*, being hollow, and made up of all circular Fibres, wherewith the Bees ſuck the Honey from the Flowers.

The Globulets which break forth from the Attire of Flowers, deſcribed by Dr. *Grew* and *Malpighius*, which are for the moſt part of an oval Figure, and of different Colours, (ſome white, ſome yellow, ſome red) ſeem to be Bags of Liquors, and are the Materials which the Bees carry in for their *Wax*, as is evident not only from the different Colours of the *Wax* upon their Legs, according to the different Colours of the *Globulets* of the reſpective Flowers we ſee them light upon; but for that alſo if you take them gathering *Wax* from any particular Flower, and view a ſmall Parcel of that Wax with a *Microſcope*, you will find it to conſiſt of the Globulets of the ſame Flower; tho' it is not ſo eaſie to diſcover what Liquor they make uſe of, to cauſe them to ſtick together.

On the inner ſide of the hinder Legs of Bees, on the Joint towards the Toe, next to that on which they carry the *Wax*, there are a great many Rows of yellow, ſharp-pointed, ſtiff Briſtles, ſet all in order like the Teeth of Combs for *Lint*, which I look upon as the Inſtruments wherewith they break theſe Globulets, and prepare their Wax.

The Generation of a ſort of Bees in old Willows, by Sir. Edm King, n. 65. p. 2098.

XVII. 1. About the Beginning of *May*, 1670. Sir *J. Bernhard* ſent me a piece of old *Willow-Wood* out of *Northamptonſhire*, in which were lodged many Inſects curiouſly wrapt up in green Leaves, in ſeveral Channels or Burrows, each with 12, 14 or 16 Leaves round the Body, and ſeveral of them with as many little round Bits of Leaves at each end, to ſtop them up cloſe. Theſe thus made up, are near an Inch long, or the beſt part of an Inch, put in one after another into a Bore made in the Wood, fit for their Reception. They are in the manner of Cartrages of *Powder*, wherewith Piſtols are wont to be charged. In ſome part of thoſe Burrows, they are placed ſo near one another as to touch; in others, at ſome conſiderable Diſtance. Theſe Inſects obſerve this Method in placing themſelves, that ſometimes they make a direct Way into the Length of the Wood, ſometimes they bore out into the Side, and run another Way; thoſe Channels being not unlike the Burrows of *Rabbets*, all which they fill up with theſe round Appearances of wrapt Leaves, all regularly wrought. In which I find either ſomething alive, or Appearances of ſomething that hath dyed there, and is putrify'd: In ſome a great Number of Mites, of a dark Aſh Colour, ſhaped not unlike common Mites; in others, I find ſeeming Excrements of ſome ſmall Inſect, with the decayed Parts of the Dead Inſect; in others, white Maggots. Some of theſe Maggots I took out of their *Thecæ*, or Bag, and put them in warm Places in the Sun, and they thereupon grew ſomething bigger, but changed not Shape nor Colour, but dyed. The reſt I kept cloſe in a Box till the 3 of *July*. Then I took one of them out of the Wood, and opened the Leaves, and felt ſomething ſtir, hearing alſo an humming Noiſe like that of a Bee; and as ſoon as I had opened the *Theca* a perfect Bee did fly out againſt my Window, as ſtrongly as a Common Bee out of a Hive, having much of the Colour and Bigneſs of thoſe when they are New-Flyers. The reſt, being diſturbed, Eat themſelves out: They have all Stings like Bees; and I am of Opinion, that they are Common Bees.

2. I have had the good Luck to find a great many of theſe *Cartrages* in a *Rotten Willow*; and, by the ſhape of the *Maggot*, was confident, they would produce *Inſects* of the *Bee Tribe*. Mr. *Snell*, an Ingenious Gentleman, brought of them to the *Wells* at *Aſtrop*, and directing me to the Place where he got them, I there found great Plenty in the Trunk of a dead *Willow*: Beginning to unfold ſome of them, Mr. *Wray* immediately judged them to be made up of pieces of *Roſe Leaves*, and called to Mind, that this very Spring Mr. *Fr. Geſſop* brought him a *Roſe Leaf*, out of which himſelf ſaw a *Bee* bite ſuch a piece and fly away with it in her Mouth. Whereupon, ſearching the *Roſe Trees* thereabout we found a great many *Leaves*, with ſuch pieces bitten out of them, as theſe *Cartrages* are made up of. The *Cuniculi*, or *Holes*, never croſs the Grain of the Wood, excepting where the *Bee* comes in, and where they open one into another. From the Place of Entrance, they are wrought both upwards and downwards; ſo that ſometimes the *Bee Maggot* lies under her Food, and ſometimes above it. One end of the *Cartrage*, *viz.* That which is next the entrance, is always a little *Concave*; the other end, which is fartheſt from the entrance, a little *Convex*; and is received into the *Concave* of the next beyond it. The ſides of the *Cartrage* are made up of Oblong pieces of *Leaves*, and paſted together, the ends of Round ones, and where ever they do not lie cloſe one to another, the intermediate ſpace is filled up with a Multitude of theſe little Round Pieces, laid one upon another.

By Mr. Fr. Willoughby. ib. p. 2100.

The *Cartrages* contain a *Pap*, or *Batter*, of the Conſiſtence of a Gelly, or ſomething thicker; of a middle Colour between *Syrup* of *Violets* and the *Conſerve* of *Red Roſes*; of an *Acid Taſte*, and unpleaſant *Smell*. In each of theſe, at the *Concave* end there lies one *Bee-Maggot*, which feeds upon the forementioned matter, till it grows to its full bigneſs, and then makes and encloſeth herſelf in a *Theca*, or *Husk*, of a dark red Colour, and Oval Figure; in which ſhe is Changed into a *Bee*. The Remainder of her Food you may find dried into Powder at the *Convex* end, and her *Excrements* at the *Concave* without the *Theca*.

The Bees were of a ſhorter and thicker Shape, than the Common Honey Bee, more Hairy, *&c.* But the ſureſt Mark to Diſtinguiſh them is, that the *Forcipes* or *Teeth* of theſe are bigger, broader and ſtronger; in Shape like thoſe of a *Waſp*, or *Hornet*; from which ſhe alſo ſufficiently differs, in having a Tongue like a Bee, which they want.

They made their way out along the Channel thorough all the intermediate *Cartrages*, and not through the Solid Wood. Of the Corruption of the Matter within the Caſes, when the *Bee Maggots*, or *Nympha*, happen to miſcarry are Bred, Firſt, little *Hexapods*, which produce *Beetles*; Secondly, *Maggots* which produce *Flies*; Thirdly, *Mites*, &c.

From what hath been obſerved concerning this Bee, and by a great many more Parallel inſtances, it appears that it is the *Bee Maggot*, and not the *Old Bee*, that Covers the Cells before the Change: For here the old Bee, when ſhe hath left Proviſion enough with an *Egg*, Cloſes up the *Cartrage*, and hath no more to do; the *Maggot* a great while after making the *Theca*, which is Analogous to the Cover of the Cells.

By Dr. Liſter. n. 160. p. 594 3 I have obſerved that the Bees breeding in Caſes of Leaves are not very ſcrupulous in the choice of thoſe Leaves, but will make uſe of *Exotick Plants*; ſuch as *Blue-Pipe* or *Syringe Tree*. Here is a very ſtrange *Oeconomy* of Nature yet unſolved: The furthermoſt Bee, ſays Mr. *Willaughby*, makes her way out along the Channel through all the intermediate *Cartrages*: And according as theſe Channels run upwards or downwards in the Body of the *Tree*, the *Maggot Bee* at the far or upper end of each Channel is firſt Laid, and it ſhould ſeem both Hatched and Perfected firſt. But I take it otherwiſe, that that *Bee* which is neareſt Day, although it be laſt lain, is yet the firſt Hatched, and I ground my Conjecture upon this, that 'tis Probable, that the *Eggs* in the Mother are all fit for Laying, or equally Ripe, or Forward, as we ſay, at the time that the firſt of them was laid, but are not therefore all laid by the Dam, until ſhe has Provided them o[illegible]eat and a Houſe, each ſeparately, as is the Nature of *Bees*; and yet [illegible] Recompence, the Warmth of her Body, or rather the daily encreaſing Heat of the Summer-Seaſon, to which the *Mother Bee* is continually expoſed, (whilſt the firſt laid *Eggs* are ſheltered in their deep Channels,) haſtens their Vitality ſo much, that they are hatched Worms, and begin to Feed, before the Firſt laid, and conſequently are firſt perfected into *Bees*: But this is Conjecture only, and not Obſervation.

4. The *Cartrages* that I got at *Aſtrop* in *Auguſt* 1670. do now in *July* 1671. By Mr Fr. Willoughby n. 74 p. 2221 almoſt every Day afford me a *Bee*: And I can hear them Gnawing out their way before I ſee them. So that there is nothing irregular in the [illegible] of *breeding* of theſe Bees: But the Contrivance of God and Nature in it is very Admirable. Having ſhut their Young ones in thoſe Cells with ſufficient Proviſion, they all, as well the uppermoſt as lowermoſt, before Winter, come to full Growth, or are turned into *Nympha*'s; in which Condition they are deſigned to lie all Winter, as the moſt of *Inſects* do. The next Summer, those muſt neceſſarily be firſt excited out of their *Torpor*, and Changed into Flyers, by the External Heat and Air, that lie next it. If any be laid ſo late, that they have not time enough to come to the State of *Nympha*'s before Winter, they will moſt certainly die; and then it is no loſs nor inconvenience, tho their Cells be Perforated.

XVIII. M

A ſtrange ſort of Bees in the *Weſt Indies*; By M. *Villermont* n. 178. p. 1030. *Fig.* 186.

XVIII. M. *Villermont* has received from *America* a ſort of *Honey Comb*, (of a different make from the *European*) which is compoſed of ſmall *Bottles*, or *Bladders*, of *Wax*, of a browniſh Colour, inclining to Black; being as big as *Olives*, and ſhap'd like the *Spaniſh Olives*. They hang together in Cluſters, almoſt like a bunch of Grapes, and are ſo contrived, that each of them has an Aperture during the time of Work, but it is clos'd up as ſoon as the Veſſel of *Wax* is fill'd with *Honey*; and then the *Bees* go to Work with another Veſſel.

Their Lodgings are ordinarily taken up in a *Hollow Tree* or the Cavity of a Rock, by the Sea-ſide; theſe being the propereſt Places to ſecure them from ſuch Animals as are greedy of their *Honey*, and therefore likely to moleſt them: And they have the more need of this Caution, becauſe they are more lyable to be diſturbed than *Ordinary Bees*, as having no Stings, and being capable of doing good, but no hurt to any thing, as the Party that lived at *Cayenne*, very well knows. When the Combs are Removed, they muſt be carried gently, and in the ſame Poſition they lay in, till you come to the Place where you deſign to take out the *Honey*.

The *Honey* it ſelf is Clear and Liquid as Rock Water, and hardly to be diſtinguiſh'd from it by the ſight. When you would take it out, you muſt Pierce every Bottle a little more than ⅓ from the *bottom*; for if you Pierce it lower, you find a *bottom*, or Sediment, whoſe thickneſs would hinder it from running: and as you Prick every *Bottle*, you muſt have ſome Veſſel ready to receive what comes from it. This Gentleman ſays, that he thinks the *Liquor* is one of the moſt agreeable things in the World. If you drink Faſting the Quantity of a good Glaſs, or about half a Pint, it will give you 2 or 3 *Stools* in about 2 Hours time; according to the Temperament of the Party; but if you drink it at Meals, it does not Purge at all.

An Early Swarm of Bees, By Mr Rich Reed, n. 90. p. 1158

XIX. On *Thurſday Mar.* 9. 167$\frac{0}{1}$. there was at the next Houſe to mine (in *Herefordſhire*) a *Swarm* of *Bees*. It was a very fair Day to Entice them: but elſe we never have them till the middle of *May*. I had it from the Owner, one *Parry*, now in my Work: And I enquired of him, whether they did not all leave the *Hive* (as ſometimes they do unſeaſonably) either for want of Food, or out of diſtaſte? He told me, no, but there are as many left behind as came forth. But I (who have ſome time ſtudied the Regiment of that little induſtrious Wiſe Creature) do conceive, that Poverty drew them abroad to ſeek their Fortunes; the infinite Wiſdom having imparted ſuch a Providence to that little *Common Wealth*, as to ſend Part of their Company abroad to Shift, before their whole Stock of Food ſhall be conſumed to the Deſtruction of them all.

A Bee-Houſe uſed in Scotland; By Mr H. Oldenburg n. 96. p. 6076

XX. *A*. The *Bee Houſe*, lying on one ſide, with the Frame placed in it.
BBBBBBBB. The Frame.
CCCC. The Screw Pins that hold the Frame faſt.
B. The Square Hole at top open.

E.

E. The Windows.
Fig. 187. *F.* The Door, for the Bees to go in and out.
G. The Place by which the Knife enters to cut the *Honey Combs* aſunder upon occaſion.
H H. The inward Creaſe at the *bottom.*
A. The *Bee-houſe* ſet upright.
Fig. 188. *B.* The Square hole, through which the Bees work downward.
C. The Shutter that covers the Hole upon occaſion.
D. The Door for the Bees.
E. A Sliding Shutter that covers the Door in *Winter.*
F. The *Window.*
G G. The Handles for lifting all.
H H. The outward Creaſe at the top, for faſtening one Bee Houſe over another.
A. the Frame for the Bees to faſten their *Work* upon.
Fig. 189. *B B.* The Screw Nails.

This Bee Houſe, (which was ſent by Sir *Will. Thompſon*) is made of *Wainſcut*, about 16 Inches in height, and 23 in breadth between the oppoſite ſides. It hath 8 ſides, each almoſt 9 Inches in breadth. It is cloſe covered at *Top* with Boards, having a Square Hole in the middle, 5 Inches long, and about 4 Inches broad, with a *Shutter* that ſlides to and fro in a Groove about half an Inch longer than the Hole. It hath 2 Windows, Oppoſite to one another; and may have more of any Figure, with Panes of *Glaſs* and *Shutters.* The Door for the Bees is divided into 3 or 4 Holes, about half an *Inch* wide, and as high with a *Shutter* that Slides in a Groove to cover them in *Winter.* It hath 2 *Iron Handles* with Joynts to be placed about the middle, if there be no *Windows* on the ſides where they are, or above them, if there be. At the *Top* it hath a *Creaſe* all round it, about half an *Inch* in depth on the out ſide, and 1½ *Inch* high; and another on the inſide at the *bottom*; which ſerves to fix them when ſet upon one another. It hath alſo a Hole about 2 *Inches* in height and as much in breadth on one ſide at *bottom*, by which the Knife is put in to cut the Bees Work, that paſſes through the Hole from one Bee Houſe into another, as they work downward into the Empty Houſe, which hath a ſliding *Shutter* to cover it. Within the Bee Houſe there is a *Square Frame* made of 4 Poſts joyned at *top*, at *bottom*, and in the *middle*, with 4 *Sticks* for the Bees to faſten their Work upon: Which though they will ſerve, yet it may be ſecurer to have 2 more added in every of their Places, croſſing the Frame either from the middle of the Oppoſite ſide *Sticks*, or from the Angles where the Poſts are placed.

This manner of Bee Houſe is uſeful for preventing the Swarming of Bees: For, when the Bee Houſe wants Room for the Young Bees, 'tis known that they Swarm and fly away to find a Houſe for themſelves: Which is prevented by placing an Empty one made thus under the full one, having the Door at the top open, that they may Work downwards into it. And when both are full, the Bees will all be in the loweſt Houſe; and then to get the *Hony*

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Fig. 187.

Fig. 188.

Fig. 189.

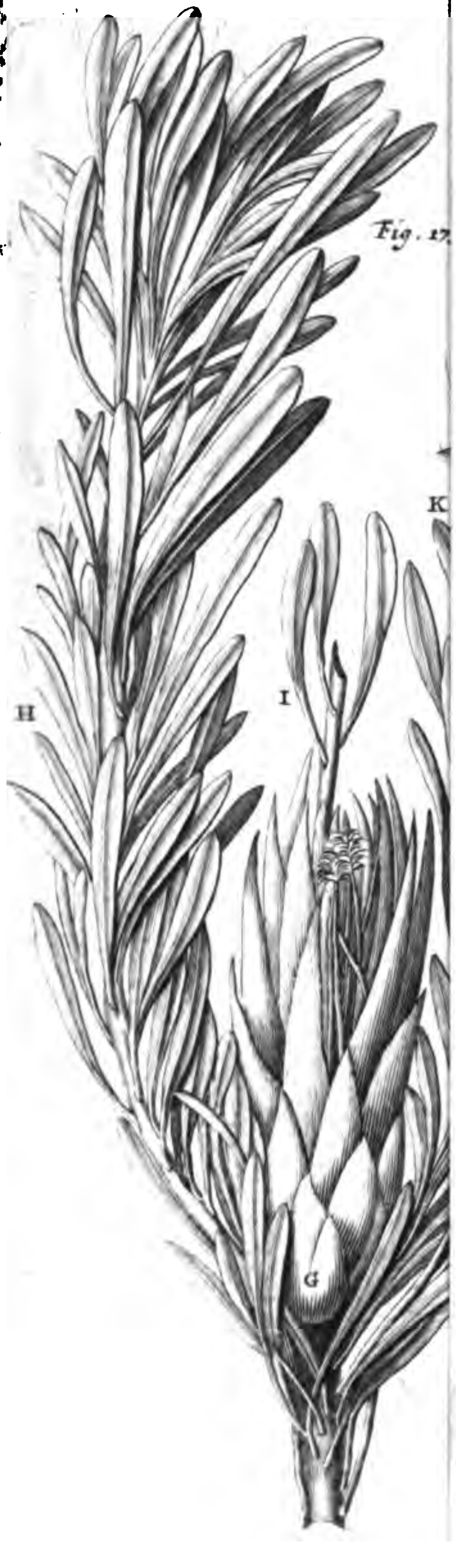

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Fig.18

Fig.18

and *Wax* without deſtroying or troubling the Bees, with a thin long Knife, broad at the end and ſharp on both ſides, the Bees-work is to be cut as low as can be, and the uppermoſt Bee Houſe to be lifted off by the Handles; and being reverſed, the Screws are to be taken out, and then the Frame, with all the Bee's-work upon it, will eaſily ſlip out, and ſo the Empty Bee Houſe may be forthwith ſet under the other, if need be, and the uppermoſt having the Square Hole above covered with the *Shutter*, ſome other cover may be ſet over it, to keep the Bees from the injuries of the *Weather*. And if this Separation be made in the Spring, or Summer, the Bees will love their New Houſe the better that it hath been uſed before.

Swarms of Locuſts in Wales, *By* Mr Edw. Floyd, n. 208. p. 46.

XXI. I am inform'd that great Swarms of *Locuſts* have lately appeared in *Wales*. They were firſt ſeen about the 20*th* of *October* 1693. ſcattered about the Fields in *Marthery* Pariſh in *Pembrokeſhire*: Where they were generally taken notice of at firſt, becauſe of the unſeaſonableneſs of the Time for *Graſhoppers*; but afterwards, for that upon further Examination, they found them diſtinct from our *Engliſh Graſhoppers*, in bigneſs, colour, *&c.* I could not learn, that any of them have been ſeen Flying in that Country: But from *North Wales* I am informed, that two vaſt Swarms of them had been ſeen in the Air not far from *Dol-gelheu*, a Market Town of *Merionydh-ſhire*, and I gueſs by the Date of my Friend's Letter, that it was near the ſame time that thoſe others of *Pembrokeſhire* had been taken Notice of in the Fields.

They are of the ſame Species with ſome *African Locuſts* in my Cuſtody in the *Muſæum Aſhmol*, for which we are obliged to Mr. *J. Aubrey*, who received them ſome Years ſince from *Tangier*. This *Pilgrim Locuſt* I call *Locuſta Erratica, Alis Ichthyocolla adinſtar Pellucidis, Reticulatis Maculis conſperſis.* It is in length (from the Head to the tips of the *Wings*) 3 *Inches* and ¼ of a Reddiſh Colour all over, except the *Wings*. As to the *Head* and *Caputium*, it reſembles the fourth *Fig.* of *Mouſett*. The Eyes are Prominent and very large, ſomewhat of the form and bigneſs of *Gromwel-Seeds*, of a Reddiſh Colour, Elegantly Streaked.

The *Antennæ* are about the bigneſs of a *Hog*'s *Briſtle*, and Curiouſly *Geniculated*. The firſt pair of Legs are not quite an *Inch* long; the Second ſomewhat above that length; but the Third 2 *Inches* and ¼. Theſe Hind Legs are very beautiful, for the Thighs are *Hexangular*, and Elegantly ſcaled on the outſide, with a black Liſt extended length-ways through the midſt of them. The Shanks are of a lively Red Colour, adorned on the hinder part with 2 orders of ſmall ſharp Prickles, placed not Oppoſite to each other, but Alternately. The Wings are about 3 *Inches* long, reſembling very much thoſe of the larger *Libellæ*, or *Dragon-flies*, but all over Garniſhed (the outer Wings at leaſt) with *Reticulated black Spots*.

Plin. Lib. xi. c. 29. Jul. Obſequens in *Lib.* Prodigiorum, Mouſett

I ſee not much Reaſon to doubt but that theſe are the very ſame Species of *Locuſts*, ſo Famous in Hiſtory for their Wandring over, and Depopulating whole Regions.

Green-Worms in Wales; By Mr Edw. Floyd, n. 208. p. 45

XXII. I find in a *MS Hiſtory* of *Pembrokeſhire* (written about the Year 1603. by one Mr. *Geo. Owen*, a Gentleman of that Country, who ſeems to have been a Perſon of conſiderable Accuracy and Veracity) that about the beginning of *June* 1601. a piece of Ground to the Quantity of 200 *Engliſh Acres*, was covered ſuddenly (as if the ſame had fallen in a Shower out of the Air) with a kind of *Caterpillars* or *Green Worms*, having many Legs, and bare without Hair. They were found in ſuch Abundance, that a Man treading on the Ground ſhould tread upon 20 or 30 of them: And in this ſort they continued for the ſpace of 3 Weeks or more no Man knowing how they came, nor any of the like ſort were ever ſeen in the Country before nor ſince, and being opened there was nothing found within them but Graſs. The Place was on a Hill in the Pariſh of *Man-Clochog* above *Hynnen-Dhewi* or *Phynnon Dhewi*. They were found as it were with one accord to go one way, *viz.* up the Hill, and went over the Hill a Quarter of a Mile and more. And as they went they devoured and conſumed the Graſs, that the Ground appeared bare and *white* like *Tallow*. And after they had continued there 3 Weeks, there reſorted thither an Infinite Number of *Sea-Maws* and *Crows*, as if all of many Countries had been ſummoned thither, who in few Days conſumed them all. Alſo *Swine* fed upon theſe *Worms* eagerly, and waxed very fat.

Swarms of Beetles in Ireland; By Dr Tho. Molyneux, n. 234. p. 741.

XXIII. According to the beſt account I can get of the vaſt *Swarms* of *Inſects* which of late Years have much Infeſted this Kingdom of *Ireland*, I find that this Flying Army was firſt taken Notice of in the Year 1688. They appeared on the *South Weſt* Coaſt of the County of *Gallway*, brought thither by a *South Weſt Wind*, one of the Common, I might almoſt ſay *Trade winds*, of this Country. From hence they made their way into the more Inland Parts, towards *Hedford*, a place belonging to Sir *George* St. *George*, Bart. about 12 Miles North from the Town of *Gallway*. Here and in the adjacent Country, Multitudes of them ſhewed themſelves among the Trees and Hedges in the Day time, hanging by the Boughs thouſands together in Cluſters, ſticking ſo the Back one of another, as in the manner of Bees when they Swarm. In this Poſture, or lying ſtill and cover'd under the *Leaves* of the *Trees*, or Clinging to the Branches, they continued quiet with little or no Motion during the heat of the Sun: But towards Evening or Sun-ſet, they would all Ariſe, Diſperſe, and Fly about, with a ſtrange Humming Noiſe, much like the Beating of Drums at ſome Diſtance, and in ſuch vaſt Incredible Numbers, that they darkened the Air for the ſpace of 2 or 3 Miles ſquare.

Thoſe that were Travelling on the Roads, or abroad in the Fields, found it very uneaſy to make their way through them, they would ſo beat and knock themſelves againſt their Faces in their Flight, and with ſuch a Force, as to ſmart the place where they hit, and leave a Slight Mark behind them.

A ſhort while after their Coming, they had ſo entirely Eat up and deſtroy'd all the Leaves of the Trees for ſome Miles round about, that the whole Country though it was in the middle of Summer, was left as bare and naked as if it had been in the depth of Winter: And the Grinding of the Leaves in the Mouths of this vaſt Multitude altogether, made a Sound very much reſembling the Sawing of *Timber*.

They came alſo into the Gardens, and deſtroy'd the *Buds*, *Bloſſoms*, and *Leaves* of all the *Fruit Trees*, that they were left perfectly naked; nay, many of them that were more Delicate and Tenderer than the reſt, loſt their Sap as well as Leaves, and quite Withered away, ſo as they never Recovered it again, particularly ſeveral Trees in the Curious Plantation of one Mr. *Martin*.

Nay their Multitudes ſpread ſo exceedingly, that they got into the Houſes, where Numbers of them Crawling about, were very Irkſom; and they would often drop on the Meat as it was Dreſſing in the Kitchin, and frequently fall from the Ceiling of the Rooms into the Diſhes as they ſtood on the Table while they Eat; ſo extreamly Offenſive and Loathſom were they.

Their Numerous Creeping Spawn, which they had lodged under Ground next the upper Sod of the Earth, did yet more harm in that Cloſe Retirement, than all the Flying Swarms of their Parents had done abroad: for this young Deſtructive Brood lying under Ground fell a Devouring the *Roots* of the Corn and Graſs, and Eating them up Ruined both the ſupport of *Man* and *Beaſt*. This Spawn, when firſt it gave ſign of *Life*, appeared like a large *Maggot*, and by taking Food and increaſing every Day became a bigger Worm, till at length it grew as big as a great *White Caterpillar*; from whence according to the uſual *Transformation* Natural to theſe ſmaller Animals, came forth this our *Flying Inſect*.

The Rage of this Plague of *Vermin* was fortunately Check'd ſeveral ways; High Winds, Wet and Miſling Weather deſtroyed many Millions of them in one Days time: Whence I gather, that though we have them in theſe *Northern* Moiſt Climates, they are more Natural, and more peculiarly belonging to Warm and Dry Countries. Whenever theſe ill Conſtitutions of the Air prevailed, their Bodies were ſo enfeebled, they would let go their Holds, and drop to the Ground from the Branches where they ſtuck, and ſo little a fall as this, at that time, was of ſufficient force quite to Diſable, and ſometimes perfectly Kill them. Nay, it was obſervable, that even when they were moſt Agile and Vigorous, a ſlight Blow or Offence would for ſome time hinder their Motion, if not deprive them of Life.

During theſe unfavourable Seaſons of Weather, the Swine and Poultry of the Country watched under the Trees for their Falling and Eat them up in abundance being much pleaſed with the Food, and thriving well upon the Diet. Nay I have been aſſured, that the Poorer ſort of the *Native Iriſh* (the Country then labouring under a Scarcity of Proviſion) had a way of Dreſſing them, and lived upon them as Food.

In a little time it was found that Smoak was very Offenſive to theſe Flies; and by Burning Heath, Fern, and ſuch like Weeds, in this or that Corner of their Gardens or Orchards, which lay moſt convenient for the Wind to diſperſe it among the *Trees*, they would ſecure their Gardens and Prevent their Incurſions; or if they had entered, drive them out again.

But towards the latter end of the Summer, they conſtantly Retired of themſelves; and ſo wholly Diſappeared, that in a few *Days* you ſhould not ſee one of them left. Some think that they take their Flight like Swallows, and other Birds of Paſſage, as they are called, to a more diſtant *Country* and Warmer Climate. But the true Reaſon of their Diſappearing I take to be, that after their *Coition* is over, (for 'tis about this time they are ſeen to Couple by faſtening to one another by their Tails) they Retire under Ground, in order to lay their Spawn there, for a ſucceeding *Generation*; and likewiſe to compoſe and ſettle themſelves to Sleep for the reſt of the enſuing Year, as ſeveral other Animals are known to do; for inſtance, *Snails* among *Inſects*, the *Hedg-Hog* among the Beaſts; and as I have good Reaſon to think, the *Ortygometra*, or *Rail*, among the Birds. And what further Confirms me in this Opinion, concerning theſe Inſects, is, that I am certainly informed by ſeveral good Hands, that in the Spring time, by accidental Digging and Ploughing up the Ground great Hollows or Neſts of them are frequently diſcovered and broken up, where they find whole Buſhels together in one heap, but in ſuch a quiet Condition they ſeem to have but little *Life* and *Motion*; for they do not Stir unleſs you Touch or Diſturb them, and then move but little and *Feebly*, as if they had been a Sleep and were wakened out of it. Theſe large Caverns to which they Retire are often met with under a firm ſolid Surface of Earth that has not been Stired or Ploughed in many Years before; and no manifeſt Paſſage can be diſcovered how they got there.

In the Summer (1695 or 96) all along the *South Weſt* Coaſt of the *County* of *Gallway*, for ſome Miles together, there were found Dead on the Shoar ſuch infinite Multitudes of this *Vermine*, and in ſuch vaſt Heaps, that by a Moderate Eſtimate, one computed there could not be leſs than 40 or 50 Horſe Loads in all. Theſe, as I take it, were a *New Colony* or *Supernumerary Swarm* from the ſame place whence the Firſt ſtock came to us in 1688 driven by the Wind to Sea from their Native Land, which I conclude to be *Normandy* or *Brittany* in *France*, it being a *Country* much infeſted with this *Inſect*, and that lies very open and expoſed to all theſe Parts of *Ireland*, and from whence *England* heretofore has been Peſter'd in the ſame manner with
Moufett de Inſect. p. 160 Swarms of this *Vermin*. But theſe meeting, by good Fortune, with a contrary Wind before they could reach Land, their Progreſs was ſtopt, and tired with their Voyage, they were all driven into the Sea, which by the Motion of its Waves and Tides caſt their Floating Bodies in heaps upon the Shore. And this was a moſt lucky Accident; for had this Second ſupply arrived, they would have exceedingly encreaſed the Numbers of thoſe which are already very troubleſome to us.

It is obſerved that they ſeldom keep above a Year together in a Place; and they Compute their uſual Stages, or March, to be about 6 Miles in a Year. Hitherto they have directed their Progreſs *Weſterly*; following the Courſe of that Wind which Blows moſt *commonly* in this *Country*.

And this laſt Year, 1697, they reached as far as the *Shannon*, and ſome of the ſcatter'd looſe Parties croſt the River, and got into the Province of *Leinſter*, but they were met there by a ſtronger Army of *Jack Daws*, which devour'd great Numbers of them. They begin to be apprehenſive of them in the *Queen*'s County, but they hope to divert their Paſſage thither by firing the *Heath* upon the Mountains between them and the *King*'s *County*.

Where-ever the *Country* has been infeſted with this *Vermin*, by one conſent, though erroneouſly they have given them the Name of *Locuſts*. But the true *Locuſt*, much reſembling in Shape a common *Graſhopper*, tho' larger, is quite a different ſort of *Inſect* from this, which belongs to that *Tribe*, call'd by the *Naturaliſts* Κολεόπτερα, or *Vagini-pennis*, the ſcarabeus or *Beetle-kind*, that has ſtrong thick Caſes to defend and cover their tender thin *Wings*, that lie out of Sight and next the Body. And this Species is certainly that particular *Beetle*, called by *Ariſtotle* in his *Hiſt.* of *Animals* Μηλολόνθη, from its devouring the *Bloſſoms* of *Apple-trees*, and is the *Scarabæus Arboreus* of *Moufet* and *Charleton*; called by the *Engliſh*, *Dorrs*, or *Hedge Chafers*. They are much of the Bigneſs of the common black *Beetle*, but of a *Browniſh Colour*, ſomething near that of *Cinnamon*, they are thickly beſperſed with a fine, ſhort, downy Hair that ſhews as if they were powdered all over with a fine ſort of *Duſt*; the Caſes of their Wings do not entirely cover all the Back, for their long picked Tails, where lie the Organs for Generation, reach a good Way beyond them; and the Indentures or Joints of each ſide their Belly, appear much whiter than the reſt. They are *exactly* figured by Dr. *Liſter*, *Scarab. Tab. Mut.*

Hiſt. Animal.

Aldrovand. de Inſect. l. 4.

I am fully convinced that this Inſect is that ſelf ſame to which the *Septuagint*, and the *vulgar Latin Tranſlation* retaining the *Greek* Word, give the *Name* Βροῦχος, or *Bruchus*, derived from Βρύχω *Frendo vel ſtrideo*, intimating the remarkable Noiſe it makes both in its eating and flying. It is often mentioned in *Holy Scripture*, *Lev.* 11. 22. *Joel* 1. 4. and 2. 25. *Nah.* 3. 16, 17. But I find our *Engliſh Verſion* almoſt conſtantly tranſlates this word Βροῦχος, tho' improperly, as I think, *Cancer-Worm*; ſince this denotes only a *Reptile*, or *creeping Vermin*, whereas that Word imports certainly a flying *Inſect*; For the Βροῦχος, *Nah.* 3, 16, 17. is expreſſly ſaid to fly, and have Wings, and its Nature and Properties are moſt truly and particularly deſcribed in theſe Words, *It ſpoileth and flyeth away, they camp in Hedges in the Day, and when the Sun ariſeth they flee away, and their Place is not known where they are*; That is, they then retire again to the Hedges and Trees where they lie quiet and concealed till the *Sun* ſets again.

I find indeed the Word Βροῦχος, better tranſlated *Locuſt* or *Beetle*, in that odd Clauſe of the *Jewiſh Law*, *Lev.* 11. 22. Where *Moſes* permits the *Iſraelites* to *eat* the *Locuſt* after his Kind, and the *Bald-Locuſt* after his kind, and the *Beetle* after his kind, and the *Graſhopper* after his Kind. I muſt confeſs, it long ſeemed to me very unaccountable, that here among the pure wholeſome *Creatures*, proper for human Nouriſhment, *Beetles* and thoſe other naſty, dry, and unpromiſing *Vermin*, ſhould be thought fit to be reckoned up as clean and proper for the Food of a Man: But ſince I have had ſome little Experience of what has happened among our ſelves, I cannot but admire the ſagacious Prudence of that divine *Law-giver*. 'Tis certain *Paleſtine*, *Arabia*, *Ægypt*, and the other Neighbouring Countries about them, were all extreamly ſubject to be infeſted with theſe ſorts of pernicious *Vermin*, and therefore, *Moſes* foreſeeing the great *Dearth* and *Scarcity* that they might one day bring upon his People, gives them here a permiſſive *Precept*, or a ſort of *Hint* what they ſhould do, when the *Corn*, *Graſs*, *Olive-trees*, *Fruit-trees*, *Vines*, and other *Proviſions* were deſtroyed by the *Locuſt* and Βρῦχοι, or *Beetles*, ſwarming in the Land, why then, for want of other *Nouriſhment*, and rather than ſtarve, he tells them, they might eat and live upon the filthy Deſtroyers themſelves, and yet be clean. And thus we ſee the native *Iriſh* were Authors of a Practical Commentary on this Part of the *Levitical* Law, and by Matter of Fact have explained what was the true Senſe and Meaning of this otherwiſe ſo dark and abſtruſe a Text. It is alſo more than probable that this ſame deſtructive *Beetle* we are ſpeaking of, was that very kind of *Scarabeus*, the idolatrous *Ægyptians* of old had in ſuch high Veneration, as to pay divine Worſhip to it, and ſo frequently grave its Image upon their *Agulios* and *Obeliſks*, as we ſee at this Day: For nothing can be ſuppoſed more natural, than to imagine a Nation addicted to *Polytheiſm*, as the *Ægyptians* were, in a Country frequently ſuffering great Miſchief and ſcarcity from *Swarms* of *devouring Inſects*, ſhould from a ſtrong Senſe and Fear of Evil to come, (the common Principle of Superſtition and Idolatry) give ſacred Worſhip to the viſible Authors of theſe their Sufferings, in hopes to render them more propitious for the future. Thus 'tis allowed of all Hands, that the ſame People adored as Gods, the ravenous Crocodiles of their River *Nile*; and thus the *Romans*, tho' more polite and civilized in their Idolatry, *Febrem ad minus nocendam venerabantur*, *eamque variis* Templis exſtructis *colebant*; *ſays* Valerius Maximus, L. 2. c. 5.

The Vaſa teſticularia of a Beetle, by Dr. Swammerdam, n. 94. p. 6041, 6042.

XXIV. *Scarabæi naſi Cornis* Genitalia, quoad Vaſa Teſticularia, adamuſſim cum Humanis convenire *Teſticulis*, atque ex unico tantum Funiculo, longo Cavo, innumerabiliter flexo, atque (quod nondum in Homine mihi viſum) Principio ſeu Apice Cæco, conſtare, non ſine aliquo ſtupore luſtravi.

Non alienum itaque fore duxi eorum Delineationem Cl. tuæ tranſmittere; in qua imprimis exhibentur non modo Teſticuli ex unico Funiculo duos pedes & ſex Pollices longo, ſed & Vaſa Deferentia, ſemen copioſum ac Album, quando læduntur, ſtillantia; nec non Veſiculæ ſeu potius Glandulæ ſeminales ſex, admodum elegantes; Glandularumque Seminalium ductus protenſi, materia ſeminalem ſubflavam (ut in hominibus ac Brutis quoque obſervantur) continentes.

A flying Hart, by [illegible] n. 127. p. 652.

XXV. I here ſend you the Figure of a large *Flying Beetle*, of a dark ſhining Brown, with a huge pair of Horns, in Proportion to the Body, ſhaped and branched exactly like a *Stag*'s or *Hart*'s, from which laſt it hath its Denomination; our People in *Virginia* and *New-England*, calling it a *flying Hart*. It flies high and ſwift, and reſts moſt commonly upon Branches of Trunks of ſtanding Trees, where, as ſoon as it has taken up its Station; it begins with a ſhrill chirping Voice, which it raiſes by little and little, till it makes the whole *Woods* ring again, and then leſſens gradually till it ceaſeth with a kind of ſilent Murmur; as is the little Creature had rung it ſelf aſleep; then it flies to ſome other Place, and begins the ſame Tune again.

The Horns are of a ſhining hard *Subſtance*, and the Tips of them touch the ſame Plane with the *Belly*.

A Muskſcented Inſect, feeding upon Henbane, by Dr. M. *Liſter*, n. 72. p. 2176.

XXVI. There is a *Cimex* of the largeſt Size, of a red Colour, ſpotted black, and which is to be found very frequently and plentifully, at leaſt in its Seaſon, upon *Henbane*: I therefore in my private Notes, inſtile it *Cimex Ruber*, *Maculis nigris diſtinctus*, *ſuper Folia Hyoſcyami frequens*. This *Inſect* in all Probability doth feed upon this Plant, (on which only we have yet obſerved it) if not upon the Leaves, by ſtriking its *Trunk* (the Note of Diſtinction of this Kind of *Inſect* from the reſt of the *Beetle-kinds*) into them, and ſucking thence much of its Subſtance, like as other ſorts of *Cimices*, will upon the Body of Man, *&c.* yet upon the unctuous and greaſy Matter, with which the Leaves ſeem, to the Touch, to abound. It is farther obſervable, that that horrid and ſtrong Smell, with which the Leaves of this *Plant* do affect our Noſtrils, is very much qualified in this *Inſect*, and in ſome Meaſure aromatick and agreeable, and therefore we may expect, that that dreadful *Narcoſis*, ſo eminent in this Plant, may likewiſe be uſefully tempered in this Inſect.

About the latter End of *May*, and ſooner, you may find adhering to the upper Side of the Leaves of this *Plant*, certain Oblong, Orange Coloured Eggs, which are the Eggs of this *Inſect*. Theſe *Eggs* yet in the Belly of the Females are white, and are ſo ſometime after they are laid: But as the Young ones grow near the Time of their being hatched, they acquire a deeper Colour, and are hatched *Cimices*, and not in the Diſguiſe of Worms. If the riper Eggs be cruſhed upon white *Paper*, they ſtain it of themſelves, without any Addition of Salt, with as lively a *Vermillion*, or *Coleur de Feu*, as any thing I know in Nature; *Cochineel* ſcarce excepted, when aſſiſted with *Oyl* of *Vitriol*.

Other Muſk ſcented Inſects, by Mr. J. Ray, n. 74. p. 2220.

XXVII. 1. I have ſeen two ſorts of *Inſects* which ſmell of *Musk*. The one is like the common *Capricornus*, or *Goat-Chafer*, which is mentioned by all Naturaliſts that write of *Inſects*, and which ſmells ſo ſtrong of that *Perfume*, that you may ſcent it at a good Diſtance, as it flies by, or ſits near you. The other is a ſmall ſort of *Bee*, which in the *South* and *Eaſt* parts of *England*, is frequently to be met withal in Gardens among Flowers in the *Spring-time*.

By Dr. M. Liſter, n. 76. p. 228[illegible]

2. The two *Inſects* mentioned by Mr. *Ray*, ſmell of *Musk* to an high Degree. The ſmall *Bees* are very frequent in the *Woulds* in *Lincolnſhire*, and about the latter End of *April*, are to be found in Paſtures and Meadows, upon the early blown Flowers of a ſort of *Ranunculus*, but it is ſomething im-

proper to ſay *Bees* feed on *Flowers* : And likewiſe the ſame *Bees* are no leſs frequent on the Flowers of *Dens Leonis*, &c,

The *Sweet Beetle*, is a very large *Inſect*, and well known about *Cambridge*. All the Trials I have made to preſerve them with their *Smell*, have proved ineffectual : For both ſorts of theſe *Inſects*, will of themſelves, in a very few Weeks become almoſt quite ſcentleſs.

To theſe, I ſhall add another ſweet-ſmelling Inſect, which is a Hexapode Worm, feeding on *Gallium Luteum*.

Mr. *Willoughby* informs me, that he hath found the *Goat Chaſer*, or *ſweet Beetle*, out of Seaſon as to that *Smell*. Perhaps it might be at the time of the *Coit* : For as much as at that time, when I took them highly perfumed, I had obſerved the Female full of Eggs. [illegible] 5003

XXVIII. 1. It is generally believed, that the *Cochineel* comes out of a Fruit called the *Prickle Pear*, bearing a Leaf of a ſlimy Nature, and a Fruit blood red, and full of Seeds, which give a *Dye* almoſt like to *Braſiletto Wood*, that will periſh in a few Days by the Fire ; but the *Inſect* engendred of this Fruit or Leaves, gives a permanent Tincture, as is generally known. The Cochineel, Fly by n 40 p. 796:

There grows a *Berry* (by report) both in *Bermudas* and *New England*, called the *Summer-iſland Reed Weed*, which *Berry* is as red as the *Prickle Pear*, giving much the like Tincture; out of which *Berry* come out firſt Worms, which afterwards turn into Flies, ſomewhat bigger than the *Cochineel-Fly*, feeding on the ſame *Berry* ; in which we read there hath been found a Colour, no whit inferior to that of the *Cochineel-Fly* ; and as to Medicinal Vertue, much exceeding it.

2. 'Tis alſo probable, that *Inſects* may be engendred out of other Vegetables, either Herbs, Berries, and other Fruit and *Woods*, giving the Tincture of its Original, which will hold in Grain.

3. To breed *Inſects* out of Herbs, dry them, for they yield the beſt Tincture; otherwiſe ſtamp them, and let them dry, till they will ſuffer no more Juice to run from them, (do this in the Sun, or in a proportionable Heat:) or if dried, infuſe them with Water, in a Heat for 24 Hours, then vapour away the Water, till the Diſſolution be as thick as a Syrup (but for this uſe ſtrain them not from their *Faces*) take this Maſſe and put it into an earthen or wooden Veſſel, covered with ſome *Straw*, or ſomething elſe of that Nature, that it lie not too cloſe, and ſo proportion the Quantity to the *Veſſel*, that the Air may come about, and into the *Maſſe*, yet not too much. Then ſet this Veſſel in a Ditch or Pit made in the Earth, in a ſhady Place, and put about it ſome wet Leaves, or ſome ſuch putrifying Rubbiſh, and over it a Board, and on that ſome Straw, or the like, and it will produce firſt a ſhelly, husky Worm, and then a *Fly* of the Tincture of *Concrete*, but durable, and ſomewhat more advanced. To generate other Flies, for like uſes

And as for *Berries*, ſtamp and boil them, evaporating them to the Conſiſtence of a *Rob*, and then uſe them as the former.

Laſtly, for *Woods*, infuſe them in Water being firſt pulveriz'd, and boil out their *Tincture*, and then evaporate alſo the Water to ſuch a Thickneſs, as the other, and handle them in the like Way.

The *Flies* will play about the Side of the *Veſſel*, and the Surface of the *Matter*; which taken, are to be killed in a warm Pan or Stove, and ſo dried and kept.

2. An old *Spaniard* at *Jamaica*, who lived many Years in that Part of the *Weſt-Indies*, where great Quantities of *Cochineel* is made, affirms, that the *Inſect* whereof it is made is the very ſame which we call the *Lady-bird*, or *Cow-lady*. It appears, he ſays, at firſt like a ſmall Bliſter, or little Knob upon the Leaves of the Shrub on which they breed, which afterwards by the Heat of the Sun, become a *live Inſect*, or ſmall *Grub*. Theſe *Grubs* in Proceſs of Time become Flies, and being come to full Maturity, which muſt be found out by Experience, in collecting them at ſeveral Seaſons, they kill by making a great Smother of ſome combuſtible Matter, to windward of the Shrubs whereon the Inſects are feeding (having before ſpread ſome Cloaths under the *Plants*) whereby all the Inſects being ſmother'd and kill'd by ſhaking the Plants, will tumble down upon the Cloaths; thus they are gathered in great Quantities with little Trouble. Then they ſpread them on the ſame Cloaths, in ſome bare ſandy Place, or ſtone Pavement, and expoſe them to the Heat of the Sun until they are dry, and their Bodies ſhrivelled up, which being rub'd gently betwixt ones Hands, will crumble into *Grains*, and the *Wings* ſeparate from them, which muſt be garbled out. Others, 'tis ſaid, do expoſe them to the *Sun* in broad and ſhallow *Copper Baſons*, wherein the Reflection of the Sun will dry them ſooner. By, n. 193. p. 502.

The *Tree* or *Shrub* on which they breed, call'd the *Prickle Pear*, or *Indian-Fig*, is eaſily and quickly propagated, by putting a ſingle Leaf above half its Depth into the Ground, which ſeldom fails to take Root, and throw out other new Leaves at the Top thereof. Others ſay, they may be raiſed from the Seed, or ſmall Grains, which are to be found in the proper Seaſon in the Fruit, which is ſomething like a *Fig*, ariſing out of certain yellow Flowers, or Bloſſoms, that grow out at the Tops of the uppermoſt Leaves, which Fruit is full of a red Pulp, that when full ripe, ſtains the Hands of them that touch it, like *Mulberries*, with a purple or ſanguine Colour, whereon, or on the Bloſſoms, ſome ſay the Inſects do feed; which haply may be the Occaſion of that rich Tincture within their Bowels.

3. The Figures 191, 192, 193. repreſent the *Cochineel-Fly* as ſeen on its Belly by the help of the *Microſcope*, and by the naked Eye; and as ſeen on its Back through a Microſcope. Figures of the Cochineel Fly, by Dr. Tyſon, n. 176. p. 1202.

XXIX. In *Auguſt* 1695, I traced a *Death watch* by the Noiſe, and found it in a *Copper* Body; it reſembled dry Dirt in Colour. I found another ſome Years before on a rotten Poſt. This ſmall Beetle had another anſwered it, in the ſame Room, and after a Minutes diſtinct beating, would forbear for the other to anſwer. The *Death-Watch*, by Mr. Ben. Allen, n. 245. p. 376.

The Part it beats with, is the extreme Edge of the Face; which I may call the upper Lip, the Mouth being protected by this bony Part, and lying underneath out of View.

It was ¼ of an Inch long, the Colour a dark brown, with Spots, ſomething lighter, irregularly placed, which would not rub off readily. They *Fig.* 194. ſeemed to lie rather athwart the Back, and direct on the Head; as in the ſmall Figure, 194, which is much of the ſame ſize with it, and the *Maculæ* are deſigned for the greyiſh Spots. Under the *Vagina*, are pellucid *Wings*, and the Body is of a pullous Colour. The Head appeared large, by reaſon of a large Cap or Helmet, which covered it round, only at the Ear turned up a little; from under this appeared the Head, which was flat and thin; the Eyes forwards, the Lip hard and ſhining, the Ears of the *Helmet* greyiſh. Two *Antennæ* proceeded from under the Eyes, which, by their meeting on the Breaſt, I conjectured to aſſiſt their Feeding, and to be rather proboſces; and the *Helmet* to be turned up for hearing ſake; and the Belly plicated as other *Beetles.*

The other *Beetle* that anſwered it was leſs, and the Marks on the Back, not ſo diſtinct.

By the *Microſcope* I diſcovered the *Marks* to be thick ſet ſpots of Hair, of a *Caſtor* Colour; the *Head* all hairy, and the *Face* thick of curled Hair. On the *Fig.* 195. *Belly* was a little but thin ſet Hair. The *Eyes* appeared large, as in the Figure, the ſuperficies conſiſting of many ſmall ſquares furrow'd deep between, and theſe lay in Lines tranſverſly deſcending towards the *Noſe*. Theſe *Eyes* were not moveable but contiguous to the Face, without any Cavity to receive them; and they were very opaque. The *Antennæ* proceeded from under the Eyes; the firſt large Joint having a Cavity, out of which it proceeds at the ſides of the Lip. Between the Eyes the Face riſes in a little Ridge, which is the *Noſe*, and is ſignified by the Light part of the Face. And juſt below it, the *Noſtrils* are covered by ſtrait pendulous Hair, proceeding from the lower Ridge of the *Noſe*. Under this Hair, the Cavity is dark. Below the *Noſe*, the *Lip-ſhades* ſhew the more depreſt Places. Under this Lip are viſible 4 *Forcipes*, 2 of each ſide, to lay hold on its Food.

The *Muſca Lupus* in Virginia, by Mr. J Baniſter. n. 198. p. 6 9 XXX. 1. I have obſerved, that that ſort of Flies which *Mouffet* calls *Muſca Lupus*, and ſome others, (as the *Tabani*, *Aſili*, &c.) that have but 2 Wings, have growing out of their Body, under each Wing a ſmall flexible *Apex* or *Pointel*, with which they poiſe their Body, and keep it in *Æquilibrio*, as the *Dancer* on the *Rope* does with his Pole; for pull theſe off, and their Flight is ſhort aod unſteady, nor can they, tho' they have the uſe of their Wings, guide themſelves ſo, as to keep themſelves from the Ground, or to avoid ſtriking againſt whatever is in their Way.

A Note, by Ib. p. 691. 2. Dr. *Hook* has obſerved theſe *Pendulums*, and deſcribed them in his *Micrographia*, Obſ. 38. p. 273.

XXXI. I here ſend you a *viviparous Fly*, which is one, if not the very biggeſt, of the harmleſs *Tribe* that I have met with in *England*. I call them *harmleſs*, becauſe that they are without that hard *Tongue* or *Sting*, in the *Mouth*, with which the *Oeſtrum kind*, or *Gad-Flies*, trouble and offend both Man and Beaſts. This *Fly* is ſtriped upon the Shoulders, grey and black, and as it were checkered on the Tail with the ſame two Colours. The Female may be known by a Redneſs on the very Point of the Tail. The very latter end of *May* 1666. I opened ſeveral of them, and found 2 Bags of live white Worms, of a long and round Shape, with black Heads, they moved both in my Hand, and in the unopened Veſicles, backwards and forwards; as being all diſpoſed in the Cells length-ways the Body of the Female, like a Sheaf. Some ſuch thing is hinted by *Aldrovandus*, and I ſuſpect all of this Tribe to be in ſome Meaſure *viviparous*.

A viviparous Fly, by *Dr.* M. Liſter, n. 7½ p. 217. & 160. p. 595.

Lib. 1. de Inſ.

XXXII. 1. In a great and very ancient Wall of *Free ſtone*, in the *Benedictines* Abbey at *Caen* in *Normandy*, facing ſouthward, there are to be found many Stones ſo eaten by *Worms*, that one may run his hand into moſt of the Cavities, which are variouſly faſhioned, like the *Stones* which I have ſeen wrought with ſo much Art in the *Louvre*; in theſe *Cavities* there is Abundance of *live Worms*, their *Excrements*, and of that Stone Duſt they eat. I have taken ſome of theſe living Worms, which I found in the eaten Stone, and put them into a Box with ſeveral Bits of the Stone; leaving them there together for the ſpace of 8 Days, and then opening the Box, the Stone ſeemed to me eaten ſo ſenſibly, that I could no longer doubt of it.

A Kind of Worms eating out Stones, by M. de la *Voye*, n. 18. p. 321.

Theſe *Worms* are encloſed in a *Shell*, which is *grayiſh*, and of the Bigneſs of a *Barley-corn*, ſharper at one end than the other. By the Means of an excellent *Microſcope*, I have obſerved, that 'tis all overſpread with little Stones, and little *greeniſh Eggs*, and that there is at the ſharpeſt End a little Hole, by which theſe Creatures caſt out their Excrement, and at the other End, a ſomewhat bigger Hole, thro' which they put out their Heads, and faſten themſelves to the *Stones* they gnaw. They are not ſo ſhut up, but that ſometimes they come out, and walk abroad. They are all black about 2 Lines of an Inch long, and 3 qrs. of a Line large. Their Body is diſtinguiſh'd into ſeveral *Plyes*, and near their Head they have 3 Feet on each Side, which have but two Joints, reſembling thoſe of a *Louſe*. When they move, their Body is commonly upwards, with their Mouth againſt the Stone. They have a big Head, ſomewhat flat, and even of the Colour of a *Tortoiſe-ſhell*, browniſh, with ſome ſmall white Hair; their Mouth is alſo big, where may be ſeen 4 kinds of *Jaw-bones*, lying croſs-wiſe, which they move continually, opening and ſhutting them like a pair of *Compaſſes* with 4 *Branches*; the *Jaws* on both ſides of the Mouth are all black; the *Nether-Jaw* hath a Point like the Sting of a *Bee*, but uniform; they draw *Threads* out of their Mouth with their *Fore-feet*, uſing that Point to range them, and to form their Shells of them; they have 10 Eyes, very black and round, which appear to be bigger than a *Pin*'s Head; there are 5 of them on each ſide of the Head, ſtanding as in the Figure.

Fig. 196.

Another sort eating Mortar, ib. p. 372.

2. I have alſo found, that *Mortar* is alſo eaten by an infinite Number of *ſmall Creatures*, of the bigneſs of *Cheeſe-mites*; theſe have but two *Eyes*, and are blackiſh; they have 4 Feet on each ſide pretty long; the Point of their *Muzzle* is very ſharp, as that of a *Spider*. In old *Mortar* betwixt Stones, that is found in Walls made with *Rubbiſh*, there is a great Store of them together with great Plenty of their little Eggs; You may obſerve more of them in Walls expoſed to the South, than in others, and that the *Worms* that eat the Stone, live longer than thoſe that eat the Mortar; which keep not above 8 Days alive. Without a very good *Microſcope*, and a great deal of *Attention*, 'tis difficult to ſee them well.

I have ſeen other very old Walls altogether eaten, as thoſe of the *Temple* at *Paris*, where I could find no Worms: But the Cavities were full of *Shells* of various kinds, diverſly figured, and turn'd; all which I believe to be little *Animals Petrefy'd*.

A Scolopendra, by Mr. J. Ray, n. 74. p. 2221.

XXXIII. The *Scolopendra*, which is by *Brierus* aſcribed to *Muffet*, in the latter part of his Chapter *de Julis*, p. 202. I ſaw in the Cloyſters of *Trinit* College in *Cambridge*, 12 or 13 Years ago.

A ſwarm of Flying Graſhoppers in Languedoc, by . . . communicated by M. Juſtel, n. 182. p. 147.

Vid. ſup. §. 21, 22, 23.

XXXIV. Theſe *Inſects* appear to Sight, in nothing different from the common ſort of *Graſhoppers*; but they take their Flight like Birds, which is particular to them. They are much about an *Inch* in length, of a grey Colour. In the *Year* 1685, the *Earth* in ſome Places about *Aramont* in *Languedoc*, near *Avignon*, was covered 4 *Fingers* thick with them, in the Morning before the *Heat* of the *Sun* was conſiderable: But as ſoon as it began to be hot, they took Wing and fell upon the Corn, eating up both Leaf and Ear, and that with ſuch *Expedition*, by reaſon of their great Number, that in 3 hours they devour'd the Corn of a whole Field; after which, they again took Wing, and their *Swarms* were ſo thick, that they covered the Sun like a Cloud, and were whole Hours in paſſing. They flew againſt the Wind, and went over the *Caſtle*, which is very high, and ſeized upon another Field of Corn, which they deſtroyed like the former. After having eaten up the Corn, they fell upon the *Vines*, the *Pulſe*, the *Willows*, and even the *Hem*, notwithſtanding its great Bitterneſs. Afterwards, about the End of *Augu*, they ceaſed *flying*, and copulated, and the *Female* ſtuck her Tail into th hard Earth, where ſhe caſt a Foam, and made therewith in the Ground Hole as big as that of a *Gooſe-quill*, and about an *Inch* long, wherein ſh laid her *Eggs*, which are much of the ſize of *Millet-ſeed*; there would b ſometimes 50 of theſe *Eggs* in a Hole, which are ſo covered over with th ſame *Earth*, that the Water does not get in. After this, all theſe *Inſe* died, and ſtunk very much. They began to hatch in *April*, 1686. *March*, we thought upon *Deſtroying* their *Eggs*, which lie not above a Fingers Breadth in the Earth; and we took of them 180 Quintals, being 9 *Tuns*. Since their Hatchings they have taken above 15 *Tuns* of the Young *Graſhoppers*, which are not yet bigger than Flies: And there are yet a Multitude

titude that have eſcaped us. If this Care had not been taken, there would have been enough of them to have Eaten up the Corn of the whole *Province*.

The Generation of Fleas; By S.r D'Iacinto Ceſtoni. n. 249. p. 42

XXXV. *Fleas* bring forth *Eggs*, (or a ſort of *Nits*) from theſe Eggs are hatched Worms; theſe Worms make to themſelves Bags like *Silk Worms*; and from out of theſe Bags come *Fleas*. The Eggs they depoſite on *Dogs*, *Cats*, *Men*, or other *Animals*, infeſted with them, or in the Places where they Sleep, which for being round and ſmooth, ſlip ordinarily ſtraight to the Ground, or fix themſelves in the *Plyes*, or other Inequalities, of the *Coverlets* and *Cloaths*. From theſe are brought forth *White Worms*, of a ſhining Pearl Colour, which feed themſelves on the *Bran like Subſtance* which ſticks in the Combs when Puppies are Combed to take out the *Fleas*; or with a certain the *Downy Subſtance*, that is found in the *Plyes* of *Linen Drawers* or other ſuch like *Excrement*. They come in a Fortnight, to the bigneſs of Fig. 197. and are very *Lively* and *Active*, and if they have any Fear, or if they be touched, they ſuddenly Roul themſelves up, and make as it were a Ball. A little after, they come to Creep, after the manner of the *Silk Worms* that have no Legs, with a brisk and very ſwift Motion. When they are come to their uſual bigneſs they hide themſelves, thee moſt they can, and bringing out of their Mouths the Silk, they make round themſelves a ſmall Bag, white within as Paper, but without always Dirty, and Foul'd with Duſt. The Bags are to the naked *Eye* of the bigneſs of Fig. 198. without Magnifying. In other two Weeks, in the Summer-time, the *Flea* is perfectly formed; without that the *Worm* quits its *Exuviæ* in its *Bag*; as do the *Silk Worms*, and as do all *Caterpillars*, which leave in the ſame their *Exuviæ*. The *Flea* ſo long as it is incloſed in the Bag, is Milk White, although it has its Legs, but two Days before it comes out, it becomes Coloured, grows hard, and gets Strength ſo that coming ſpeedily out, it ſtraight Leaps away. Fig. 197. Fig. 198.

Fig. 199. Repreſents the Eggs, Fig. 200. the Worm, Fig. 201. the Bag, Fig. 202. the Flea; but all *Magniſy'd* by the *Microſcope*.

The Emmet or Ant; By Sir Edmund King. n. 23. p. 425.

XXXVI. There have Occurred to my Obſervation but 3 ſorts of *Ants*, commonly without Wings; *viz* very *Black*, *Dark-brown* and *Philemort*. Each Kind inhabit by themſelves in their ſeveral *Banks*, two ſorts ſeldom or never being found together; and if either of the other two ſorts be put into the *Black Ants Bank*, 'tis Worth obſerving what Enmity there is betwixt theſe little Creatures, and with what Violence the *Black Ones* will ſeize on the *Red*, never leaving to Pinch them on the Head with their *Forceps*, or *Claws*, till they have Killed them upon the Place; which done, they will carry them Dead out of the Field, from their *Bank*. But if you put *Black Ants* into a *Bank* of the *Red*, the *Black* ſeem to be Senſible of the ſtrangeneſs of the Place they are in, that there they will not meddle with the *Red*; but as if they were Frighted, and Concerned for nothing but Self-preſervation, Run away.

Upon opening of theſe *Banks*, I obſerve firſt, a *White Subſtance*, which to the bare *Eye* looks like the Scattering of fine white *Sugar* or *Salt*, but very ſoft and tender. And if you take a bit of it, as big perhaps as a *Muſtard-Seed*, and lay it on the *Object Plate* of a good *Microſcope*, you may by opening it with the Point of a Needle diſcern many pure, white, and clear Appearances in diſtinct *Membranes* all Figured like the leſſer ſort of *Birds Eggs*, and as clear as a Fiſh's Bladder. This Subſtance, as it hath been juſt now deſcribed, I find in the *Ants* themſelves; which I take to be the true *Ants-Eggs:* It being Obvious to the Obſervation, that wherever this is uncovered, they make it their Buſineſs to carry it away in their Mouths to ſecure it, and will, after you have ſcattered it, lay it on a heap again, with what ſpeed they can. I Obſerve they lie in Multitudes upon this (if I may ſo call it) Spawn of theirs: And after a little time, every one of theſe ſmall Adherences is turned into a little *Vermicle*, as ſmall as a *Mite*, hardly diſcerned to Stir. But after a few Days more, you may perceive a *Feeble Motion* of *Flexion* and *Extenſion*, and they begin to look Yellowiſh and Hairy, ſhaped very like a ſmall *Maggot*: And ſo keeping that ſhape, grow almoſt as big as an *Ant*, and have every one a Black Spot on them. Then, they get a Film over them, Whitiſh and of an *Oval ſhape*; for which Reaſon, I ſuppoſe, they are commonly called *Ants-Eggs*; which yet (to ſpeak properly) they are not.

I have opened many of theſe, vulgarly call'd *Ants-Eggs*, I mean the leſſer Sort, (for there are ſome as big as a *Wheat Corn*, others leſs than a *Rye Corn*) and in ſome I find only a Maggot to appearance juſt as was deſcribed before. In others, I find a Maggot, beginning to put on the ſhape of an *Ant* about the Head, with two little Yellowiſh Specks, where the *Eyes* are deſigned, in others a further Progreſs, and furniſh'd with every thing to Compleat the Shape of an *Ant*: But wholly *Tranſparent*, the *Eyes* only excepted, which are then, as black as black *Bugles*. But when they newly put on this Shape, I could never diſcern the leaſt Motion, in any one part of the little *Creature* whereof the Reaſon may perhaps be, the Weakneſs of their *Fibres*; for after a little more time, when they begin to be Browniſh, they have Strength to ſtir all their Parts. At laſt, I met with ſome of theſe reputed *Eggs*, which being carefully opened by me, I took out of ſeveral of them every way perfect and compleat *Ants*; which did immediately creep about, among the reſt, no way differing from many other *Ants*, but by a more *Feeble Motion* of their Limbs. And this I took for a clear Demonſtration of what I deſigned, which was to know, that the *Film* does only cover the *Maggot*, while ſhe is *Transforming* into an *Ant*, and fit to ſhift for herſelf. The black Speck, that is at one end of every ſuch reputed *Ants Egg*, I ſuppoſe to be caſt out of the *Maggot*, in her *Transformation*: Since after it puts on the ſhape of an *Ant*, the *Speck* is quite gone, and the whole Body of the *Ant* pure clear; ſince alſo this *Speck* at the end of the ſaid Egg, lies always cloſe to the *Anus* of the Included *Ant*.

It is Obſervable how upon a breaking up of their *Banks*, they make it their Buſineſs immediately to carry their Young out of ſight again; laying the ſeveral Sorts of them in ſeveral Places and Heaps; the which if you Mingle again, or Scatter, you ſhall, laying but ſome bits of Slate, or the like, in any place they may come to and get under, after a few Hours ſee all the *Vermicles* and vulgarly call'd Eggs, laid in their ſeveral and diſtinct Parcels der ſuch Pieces of *Slate*, &c. Provided the place be not ſo Cold as to Chill their Limbs; which if it be, by being brought to the Fire, they will ſoon Recover their Strength, and fall to their buſineſs again, of ſecuring their little Ones. They know all the ſorts of their Young ſo well that you cannot deceive them though you may with *Fine Sugar*, *Salt*, or the Crums of very *White Stale Bread*, ſcattered in the Mould, where their firſt true Eggs are, as I call them, be miſtaken your ſelf, yet the *Ants* will not, nor touch a bit, of what is not their own Offſpring.

I have obſerved in Summer, that in the Morning they bring up thoſe of their Young (that are vulgarly call'd *Ants Eggs*) towards the top of the Bank: ſo that you may, from 10 in the Morning until 5 or 6 Afternoon, find them near the top; eſpecially about One, Two, or Three of the Clock, and later, if the Weather be Hot; when for the moſt part they are found on the South ſide of the *Bank*. But towards 7 or 8 at Night, if it be Cool or likely to Rain, you may dig a Foot deep before you can find them.

The Acid Juice of Piſmires; By Mr J. Wray. n. 68. p. 2063.

XXXVII. Dr. *Hulſe* in *Aug.* 1670. ſent me theſe Obſervations; “Bare an *Ant-Hill* with a *Stick*, and then caſt *Cichory Flowers* upon it, and you ſhall ſee the *Ants* creep very thick over them; now as they Creep, they let fall a drop of Liquor from them, and where that chanceth to Light, there you ſhall have in a Moment a large Red Stain. Sometimes they will be a pretty while before they Diſcolour them, and at other times, they will do it ſuddenly. At the firſt I gueſſed that being Vext, by ſtirring their Hill, they might thruſt their Stings into the Flowers, and thorow them Convey that *Sharp Liquor*: But by *bruiſing* them, and *rubbing* the *Expreſſed Juice* againſt the Flowers, I find they will be equally *Stain'd*. 'Tis a thing well known, that *Ants*, if they get into Peoples Cloaths, and ſo to their *Skin*, will cauſe a *Smart* and *Tingling*, as if they were Nettled; which I conceive is done by letting fall the forementioned *Corroſive Liquor* rather than by *Stinging*.

“To what ſort of *Liquor* to refer this Juice, I know not. I dropt *Spirit* of *Salt*, and *Oyl* of *Sulphur* upon the Flowers; but they did not Cauſe them to Change Colour. I likewiſe put *Salt* of *Tartar* upon them, and dropt thereon a little *Spirit* of *Salt*, which cauſed a ſufficient *Fermentation*; but prevailed not, to Change the Colour of the Flowers in the leaſt.

“This Obſervation holds true, not only in *Cichory Flowers*, but alſo *Lark-Spur*, *Borage*, and, I ſuppoſe, all others of a *Blue Colour*.

Some Years ſince Mr. *Sam. Fiſher* of *Sheffield*, made me acquainted with theſe Experiments, *viz.* “If with a Staff, or other Inſtrument you ſtir an Heap of *Ants*, (eſpecially *Horſe-Ants*) ſo as to Anger them, they will let fall thereon, a *Liquor*, which if you preſently Smell to, will Twinge the Noſe like newly Diſtilled *Spirit* of *Vitriol*.

“A Weak *Spirit* of *Piſmires*, will turn *Borage Flowers Red* in an Inſtant;

Vinegar

“ *Venegar* a little heated, will do the like. *Piſmires Diſtill'd* by themſelves,
“ or with Water, yield a *Spirit*; like *Spirit* of *Vinegar*, or rather like the
“ *Spirit* of *Viridi Æris*, *Lead* put into this *Spirit*, or *Fair-Water* with the
“ *Animals* themſelves being Alive, maketh a good *Saccharum Saturni*. *Iron*
“ put into the *Spirit*, affords an *Aſtringent Tincture*, and by *Repetition* a *Crocus*
“ *Martis*. Take *Saccharum Saturni* thus Made, and Diſtill it, and it will af-
“ ford the ſame *Acid Spirit* again, which the *Saccharum Saturni* made with
“ *Vinegar* will not do; but returns an *Inflammable Oil* with *Water*, and no-
“ thing that is *Acid*. *Saccharum Saturni* made with *Viridi Æris*, doth the ſame
“ (in this Reſpect) with that made with *Spirit* of *Piſmires*. When you put
“ the *Animals* into *Water*, you muſt ſtir them to make them *Angry*, and then
“ they will ſpirt out their *Acid Juice*. No *Animal* that ever we Diſtilled
“ (he ſpeaks of his Brother and himſelf) except this, Yields an *Acid Spirit*,
“ but conſtantly an *Urinous*; and yet we have Diſtilled many, both *Fleſh*,
“ *Fiſh* and *Inſects*.

In Dr. *Hulſe*'s Account, where he ſaith, that *Spirit of Salt, and Oil of Sulphur, droped upon Cichory Flowers, did not Cauſe them to change Colour*, it is to be underſtood of the Flowers Entire, and Unbruiſed: For any Blue Flowers, being a little Bruiſed, and then a Drop of *Spirit of Salt*, or any other *Acid Spirit*, let fall thereon, will turn inſtantly Red. The Reaſon is Obvious; for that the Leaves of the Flowers (as all the other parts of the Plant) being inveſted with a *Skin* or *Membrane*, the Liquor drop'd thereon cannot eaſily penetrate it, and ſo Commix it ſelf with the *Interiour Juice* or *Pulp*. Hence it is, that if theſe Flowers be put into *Cold Vinegar*, eſpecially if the Weather be Cool, they will not Change Colour for a Conſiderable time; but if you Heat the *Vinegar*, they will Change immediately.

Another Inſect yielding an Acid Juice *By Dr M. Liſter, ib. p.* 2069

2. Having obſerved that a *Piſmire* bruiſed and ſmelt to, emits a ſtrange *Fiery* and *Piercing ſavour*, like the Leaf of the Herb, by *Botaniſts* call'd *Flammula*, broken at one's Noſtrils, I have by this means found an *Inſect*, which, I ſuſpect, may yield an *Acid Liquor*, as well as the *Piſmire*; and that is the *long* and *round bodied Red Colour'd Julus* diſtinguiſhed from all other *Multipeds*, in that their Innumerable Legs are as ſmall as a Hair, and White, and in going they are moved like Waves; not rare amongſt dry Rubbiſh; no *Scolopendra*, ours being an *Harmleſs Inſect*, and that armed with *Dangerous Forcipes*. The *Body* of this *Julus* being *Bruiſed*, ſtrikes the Noſtrils exceeding *Fiercely*.

Muſk Scented Ants; *By Dr Liſter*, n. 77. p. 3002. *Vid. Sup.* §. XXVI & XXVII.

XXXVIII. *Sep.* 2. 1671. I found in a *Sandy Ditch Bank* about a Mile and an half from *York*, in the High Road to *London*, a ſort of exceeding ſmall *Piſmires* (by which Note alone I think they may be ſufficiently diſtinguiſh'd from all, at leaſt, that I have ſeen.) Thoſe without Wings, were of a *Light Yellow*, or *Flaxen*, and being broken at ones Noſtrils they emitted, like others, an *Acid* or *Sowre Scent*; but thoſe of the ſame *Bank* with Wings, were Coal Black, and theſe bruiſed and ſmelt to, Emitted a *Fragrant Smell* like *Muſk*; And an Apothecary in *York*, Famous for his Diligence in *Chymical Operations*,

did compare them (unſeen and not yet made known to him) to an Excellent *Balſam*, he is wont to prepare.

A Table of Spiders found in England; By Dr. M. Liſter, n. 72 p. 2175.

Aranei.

vel *Fila mittunt*; ut ſunt qui

aut *Prædandi* cauſa *Texunt*

vel *Reticula Orbiculata*, Numero *IX.*

1. *Araneus Subflavus*, Alvo paululum Acuminata inflexaque.
2. *Araneus Rufus*, *Cruciger*, cui utrinque ad Superiorem Alvi partem velut Singula Tubercula eminent.
3. *Araneus Cinereus*, Pictura Clunium in 5. fere partes divulſa, iiſque plenis admodum.
4. *Araneus Flavus*, 4. Albis præter Picturam Foliaceam, in Clune Maculis inſignitus.
5. *Araneus Nigricans*, Clunibus ad Similitudinem *Querni* Folii pictis.
6. *Araneus ex Viridi Inauratus*, Alvo prætenui proceraque.
7. *Araneus Cinereus*, Sylvarum incola, alvo in Mucronem faſtigiata, ſeu Triquetra.
8. *Araneus Viridis*, Cauda *Nigris* Punctis ſuperne notata, ipſo Ano *Croceo*.
9. *Araneus Pullus*, *Cruciger* in alvo plena.

vel *Plagas Globatas*, N. IV.

10. *Araneus Variegatus*, alvo Orbiculata.
11. *Araneus Rufus*, Clunium Orbiculatorum faſtigio in modum *Stellæ* Radiato.
12. *Araneus Pullus*, Domeſticus.
13. *Araneus Cinereus* Macula *Nigra* in ſummis Clunibus inſignitus, Minimus.

vel *Telas* ſive *Linteamina*. N. *VIII.*

14. *Araneus Subflavus*, Piloſus, prælongis pedibus, Domeſticus.
15. *Araneus Nigricans*, Prægrandi Macula in ſummis Clunibus, cæterum iiſdem oblique virgatis, Domeſticus.
16. *Araneus Fuligineus* e *Craven*, inſigni *Candore* diſtinctus, Cauda Bifurca.
17. *Araneus Subflavus*, *Nigricantium* Macularum Quadratarum Catena in Clunibus inſignitus; item cui utrinque ad Clunium Latera ſingulæ obliquæ Virgulæ *Flaveſcentes*.
18. *Araneus Cinereus*, Maximus, Cauda Bifurca.
19. *Araneus Niger* aut *Caſtaneus*, Glaber, Clunibus ſummo *Candore* interſtinctis.
20. *Araneus Cinereus*, Mollis, cui in alvo, oblique virgata, Macula latiuſcula e *Nigro Rubens*.
21. *Araneus* plerumque *Lividus*, ſine ulla Pictura alva Acuminata.

aut *ideo Nihil Texunt* (niſi *filorum Ejaculatio* ac *Volatus* illorſum ſpectet:) cum tamen *alias* poſſint; nimirum *Telas* ad *Tutandum Fœtum* aut ad *Hyberna*; ſed Aperto Marte *Muſcas* Venantur, atque ii ſunt,

vel *Lupi dicti*, N. V. Hi vero, cum Superioribus ſingulis 8 habent *Oculos*.
22. *Araneus Subrufus*, Parvus, Citiſſimo Pede.
23. *Araneus Cancriformis*, oculis e *viola Purpuraſcentibus*, Tardipes.
24. *Araneus Cinereus*, Alvo undulatim Picta, inſigniter Procera, Acuminata.
25. *Araneus Fuſcus*, alvo Oblique virgata.
26. *Araneus Niger*, Sylvicola.
vel *Phalangia*, ſive Aſſultim ingredientes, N. III. Hi vero 6 tantum *Oculos* habent.
27. *Araneus Cinereus*, ſive ex *Argento Nigroque* Varius.
28. *Araneus Subflavus*, Oculis *Smaragdinis*; item cui ſecundum Clunes 3. virgulæ *Crocea*.
29. *Araneus Subrufus* e *Craven*, ſive Ericetorum ſive Rupium.
vel omnino *Nulla Fila mittunt*; ut ſunt qui plerique
Longiſſimis Tenuiſſimiſque *Pedibus* donantur; atque Hi *duos* tantum *Oculos* habent *Telaque* ſive *Brachia Digitata*. N. *IV*.
30. *Araneus Rufus*, non Criſtatus, Gregatim Vivens.
31. *Araneus Cinereus*, Criſtatus.
32. *Araneus* e *Candido Nigroque* Varius, Minima Beſtiola, Sylvicola.
33. *Araneus*, ut puto, *Coccineus*, vulgo dictus, *a Tant*, *Anglice*.

Spiders darting *their* Threads *into the Air and* Swimming *in it*, *By* Dr Liſter, n. 50 p. 1014

XL. 1. I have diſcover'd that all *Spiders* that Spin in a Thread, (thoſe which we call *Shepherds*, or *Long Legg'd Spiders*, never do,) are the Makers of thoſe *Long Threads*, *in the Air in Summer*, and eſpecially towards *September*, ſo much wondered at, and in ſuch infinite Quanties every where. I exactly marked all the ways of Weaving, uſed by any ſort of them, and in thoſe Admirable Works, I ever noted, that they ſtill let down the Thread they made uſe of, and drew it after them.

At length in nearly attending on one, that wrought a Net, I ſaw him ſuddenly in the mid Work to deſiſt, and turning his Tail into the Wind to Dart out a Thread, with the Violence and Stream we ſee *Water* ſpout out of a Spring. This Thread, taken up by the Wind, was in a Moment emitted ſome Fathoms long, ſtill iſſuing out of the Belly of the Animal; by and by the Spider lept into the Air, and the Thread mounted her up ſwiftly. After this firſt Diſcovery, I made the like Obſervation in almoſt all the ſorts of Spiders, I had before diſtinguiſhed; and I found the Air filled with Young and Old, Sailing on their Threads, and undoubtedly ſeizing *Gnats* and other *Inſects* in their Paſſage; there being often as manifeſt ſigns of ſlaughter, as *Legs*, *Wings* of *Flyes*, *&c.* on theſe Threads, as in their Webs below.

One thing yet was a wonder to me, *viz.* that many of theſe Threads, that came down out of the *Air*, were not Single but Snarled, and with Complicable woolly Locks, now more now leſs, and that on theſe I did not always find Spiders, though many Times I had found two or three upon one of them; whereas when they firſt flew up, the Thread was ſtill Single, or but little Tangled, or it may be thicker in one place than another. In the End by good Attention, I plainly found them, to get to the Top of a Stalk or Bough, or ſome ſuch like thing, where they Exerciſe this Darting of *Threads* into the Air; and if they had not a mind to Sail, they either ſwiftly drew it up again, winding it up, with their Fore-feet over their Head into a Lock, or break it off ſhort, and let the Air carry it away. This they will do many times together: and you may ſee of them that have Chains of theſe Locks or Snarled Thread before them, and yet not taken Flight.

Again, I found that after the Firſt Flight, all the time of their Sailing, they make Locks, ſtill darting forth freſh ſupplies of *Thread*, to Sport and Sail by.

It is further to be noted, that theſe Complicated Threads, are much more tender, than our *Houſe Webs*.

In *Winter* and at *Chriſtmaſs*. I have obſerved them buſy a Darting: but few of them Sail then, and therefore but Single Threads only are to be ſeen. And beſides, they are but the *Young Ones*, of laſt *Autumns Hatch*, that are then employed; and it is more than probable, that the great *Ropes* of *Autumn* are made only by the great Ones, and upon long Paſſages, and *Summer* Weather, when great Numbers of *Prey*, may Invite them to ſtay longer up.

2. I have ſeen Spiders ſhoot their Webs 3 Yards long before they begin *By Dr. Hulſe,* to Sail; and then they will, as it were, fly away incredibly Swift. Which n. 65. p. 2103 *Phænomenon* doth ſomewhat Puzzle me; ſeeing ſometimes the Air doth not move a quarter ſo faſt as they ſeem to Fly. Moſtly they Project their Threads ſingle, without Dividing or Forking at all to be ſeen in them. Sometimes they will ſhoot the Thread upward, and will mount with it in a Line almoſt *Perpendicular*; and at other times, they Project in a Line *Parallel* to the Plain of the *Horizon*; as you may often ſee by their Threads that run from one Tree to another, and likewiſe in Chambers from one Wall to another.

I confeſs, this Obſervation at firſt made me think, that they could Fly: becauſe I could not perceive, how a Thread could be drawn ſo Parallel to the *Horizon* between two Walls or Trees, as aboveſaid, unleſs the Spider flew through the Air in a Straight Line.

The way for forking their *Threads*, is expreſſed by the Figure. What Rea- *Fig.* 205. ſon ſhould be given of this Dividing, I know not, except that their *Threads* being thus Winged, become better able to ſuſtain them in the Air.

They will often faſten their *Threads* in ſeveral Places to the Things they Creep upon; The manner is, by beating their *Tails* againſt them as they Creep along, which may be underſtood by the Line *a*, *b*. By this frequent *Fig.* 204. Beating in of their Thread among the Aſperities of the Place where they Creep, they either ſecure it againſt the Wind, that it be not eaſily blown away; or elſe whilſt they hang by it, if one ſtick Breaks, another holds faſt, ſo that they do not fall to the Ground.

By Mr. J. Wray. ib. 3. I had the firſt Notice of this Darting of Spiders from Dr. *Hulſe*, which was not long after Communicated to me by Mr. *Liſter*; nor is it any great Wonder, that inquiſitive Perſons, applying themſelves to obſerve and conſider the ſame Subjects, ſhould make the ſame Diſcoveries.

By —— ib. p. 2104. 4. Mr. *Liſter* intimates in a later Letter, that Mr. *Wray* knew nothing of his having obſerved the Darting of Spiders, no more than he knew that either Mr. *Wray* or any body elſe had obſerved it, until ſuch time as he occaſionally ſent Mr. *Wray* a Catalogue of our *Engliſh* Spiders, upon which Subject Mr. *Wray* put this among other Queſtions, whether he had obſerved this Darting of Spiders.

Whence it appears that this Obſervation is as well Mr. *Liſter*'s as Dr. *Hulſe*'s.

By Dr. Liſter n. 160: p. 592 5. I take the Forking of ſome Threads (for Dr. *Hulſe* excepts the moſt) to be meerly Accidental, even as it is to our Hair: Neither do I think that any ſuch thing is deſignedly done by the Animal, and for as much as I have obſerved, Spiders Threads of themſelves are exceeding ſlick and ſmooth. There is indeed a dividing in the Projection of the Threads of many ſorts of Spiders, and eſpecially among thoſe which we diſtinguiſh by the Name of *Lupi*, which Tribe is moſt frequent, and particularly delighted in Sailing, yet this Dividing is much of another Nature than Forking. Theſe *Lupi* will Dart a whole *Stamen* or *Sheaf* at once, conſiſting of many *Filaments*: Yet all of one length, all divided each from the other, and diſtinct until ſome chance either Snap them off, or Entangle them. But for the moſt part you may obſerve, that the longer they grow, the more they ſpread, and appear to a diligent Obſerver like the Numerous *Rays* in the *Tail* of a *Blazing Star*. As for that which carries them away in the Air, ſo Swift off hand, it is as I have already hinted, partly their Sudden Leap, and partly the Length and Number of the *Threads* Projected, the Stream of the Air and Wind beating more forcibly upon them: And thus we ſee a Rope that unexpectedly Slips, comes home with a ſeeming Violence, and partly (and that much too) the Poſture and Management of their Feet, which, at leaſt by ſome ſort of them, I have obſerved to have been uſed very like Wings or Oars, the ſeveral Legs, like our Fingers, being ſometimes cloſe Joyned, and other times opened, again bent, or extended, &c. according to the ſeveral Neceſſities and Will of the Sailer. To *Fly* they cannot be *ſtrictly* ſaid, they being carried into the Air by *External* Force, but they can, in caſe the Wind ſuffer them, Steer their Courſe, and perhaps Mount and Deſcend at Pleaſure: and to the Purpoſe of Rowing themſelves along the Air, 'tis obſervable that they ever take their Flight Backwards, that is, their Head looking a contrary *way*, like a Sculler upon the *Thames*. It is ſcarce Credible to what Height they will Mount: Which yet, is preciſely true, and a thing eaſily to be obſerved by one that ſhall fix his *Eye*, ſome time on any part of the Heavens, the *White Webs* at a vaſt Diſtance very *diſtinctly Appearing* from the *Azure Sky*; but this is in *Autumn only*, and that in very Fair and Calm *Weather*.

XLI. S. *Redi* having affirm'd, that Creatures reputed *venomous* are indeed *no Poyſons*, when ſwallowed, tho' they may prove ſo when put into *Wounds*, Mr. *Nath. Fairfax*, for Confirmation thereof, alledges Examples of ſeveral Perſons well known to him, (himſelf alſo having been an Eye-witneſs to ſome ſuch Experiments) who have frequently ſwallow'd *Spiders*, even of the *rankeſt kind*, without any more Harm than happens to *Hens*, *Robin-red-Breaſts*, and other Birds, who make *Spiders* their daily Commons. And having made mention of ſome Men that eat even *Toads*, he adds, that tho' a *Toad* be not Poyſon to us in the whole, yet it may invenom outwardly, according to ſome parts ſo and ſo ſtirr'd, an Inſtance whereof he alledges in a Boy, who ſtumbling on a *Toad*, and hurling Stones at it, ſome Juice from the bruiſed *Toad* chanced to light upon his Lips, whereupon they ſwell'd, each to the Thickneſs of about 2 Thumbs; and he neglecting to uſe what might be proper to reſtore them, they have continued in that miſhapen ſize ever ſince.

The innoxiouſneſs of Spiders & Toads, by Dr. Nath. Fairfax, n. 82, p. 391.

XLII. Mr. *Nath. Fairfax* relates, that a *Spider* bruiſed into a ſmall Glaſs of Water, tinged it ſomewhat of a sky Colour: and he is informed, that a Dozen of them being put in, they would dye it to almoſt a full Azure.

Spiders Tinge Water of a sky-Color, by Dr. Fairfax, n 32, p. 391.

XLIII. Upon the Diſſection of a *Rattle-Snake*, which was ſent alive from *Virginia* to Mr. *Hen. Loades*, a Merchant in *London*, I find both its external and internal Parts ſo conformable in almoſt all Reſpects to thoſe of a *Viper*, that I have taken the *Liberty* of placing it in that Claſs, and from the *Rattle* which ſufficiently differences it from other *Serpents*, [illegible] naming it *Vipera caudiſona*.

The Anatomy of a Rattle ſnake, by Dr. Edw Tyſon, n. 144. p. 25.

It was 4 foot 5 *Inches* long, the Girth of the *Body* in the largeſt Place, which was the middle, was 6½ *Inches*; the Girth about the Neck 3 Inches, near the *Rattle* 2 *Inches*, the Head flat on the top as in the *Viper*, and by the Protuberance of the *Maxilla*, ſomewhat repreſenting the Head of a bearded *Arrow*, at the Extremity of it were the Noſtrils; between them and the Eyes but ſomewhat lower, were 2 other Orifices, which I took for the Ears, but after found, they only led into a Bone that had a pretty large Cavity, but no Perforation.

Fig. 209. a. Fig. 209. b.

The Eye was round, about ¼ of an Inch Diameter: There was a large Scale jetting over the Eye, which ſeemed to ſerve as a *Palpebra* for defending it from any thing falling on it, but I could not perceive 'twas capable of cloſing, tho' inwards it ſeem'd to have a *Membrana Nictitans*, which removes any Duſt that might adhere to the Eye.

The *Scales* on the Head were the ſmalleſt of any; thoſe on the Back larger; and ſo proportionably greater to the biggeſt part of the Body, and ſo diminiſhing thence again to the ſetting on of the *Rattle*, all in Figure, ſomewhat reſembling *Parſnip Seeds*. Their Colour was various, thoſe on the *Head* like the Colour of the *Feathers* on the Back of a *Green-Finch*, ſpeckled with ſmall black *Spots*. whereof there were 4 larger and more remarkable: Thoſe on the Back were of a dark *Feuillemort*, a *black* and a darkiſh *yellow*, and ſpeckled, making a curious *Chequer* or *Dappling* on the Back by this intermixture of Colours; but as they grew nearer the *Tail*, they became darker, and at laſt almoſt black. The *Scales* on the Back had an edged riſing in the middle, which was ſtill leſs protuberant as they grew nearer the Sides, where they were flat.

The *Belly* ſeem'd flat, covered with long *Scales* of a *yellowiſh* Colour, ſpeckled black. From the *Neck* to the *Anus*, we numbred 168. beyond the *Anus* were 2 half Scales, thence 19 whole *Scales* of a *black Lead Colour*, with yellowiſh *Edges*; from thence to the *Rattle*, 6 Orders or Rows of ſmaller *Scales* of the ſame Colour. The *Scales* of the *Belly* were joined to each other by diſtinct Muſcles; the lower *Tendon* of each Muſcle being inſerted upon the upper Edge of the following *Scale*, and the other *Tendon* of the ſame Fig. 05. uu Muſcle inſerted about the middle of the foregoing *Scale*. Theſe *Muſcles* were more fleſhy towards the Middle of the Scale, and then its Fibres did run obliquely aſcending. To each ſide was appropriated a Rib, whoſe Point did join with the Extream of it, which muſt much advantage the uſe Nature ſeems to deſign them for, by ſtrengthning them to perform their *Reptile Motions*; for the *Scales* are ſo many Feet, which being free and open downwards, they thereby take hold of the Ground, and ſo contract their Body forwards, and then ſhoot out again; and ſo perform their Motion. Hence it is, that on Rocks their Motion is much quicker than on the *Earth*, or *Plains*, becauſe here they have the firmer Footing; but in ſoft Ground, tho' their Belly be fl[illegible] yet they can contract it to an *Ellipſis*, or an acute Angle, that ſo they may take the deeper Hold, as I have obſerved in a *Viper*. This Coat of *Armour* (for their Defence) is ſo curiouſly contrived, that tho' it covers the whole Body, yet by its frequent Jointings it admits of all Motions.

Having placed this *Rattle Snake* on its Back, we opened it, and obſerved, Fig. 205. rrr that the *Tendons* of the *Abdomical Muſcles* made a *Linea alba*, in the midſt of the Scales of the Belly, where likewiſe did run a large Blood Veſſel, ariſing from the *Vena Cava*, to[illegible]ards the lower Part of the Liver.

The *Wind-pipe*, which is common to it with the Viper kind, as ſoon as Fig. 205 aaa it enters the Breaſt, preſently meeting with the Lungs, conſiſts only of *ſemi-annular Cartilages*, which being joined at both Ends to the Membrane of the *Lungs* inwardly is quite open, and immediately tranſmits the Air to the *Veſicula* of the Lungs: For dividing the Wind-pipe, we perceived it Fig. 208 aaaa eaſily extended above 1½ Inch wide; whereas before it meets with the *Lungs*, the *Cartilages* are *Annular*. The *Trachaa* or *Wind-pipe* was 20 Inches long, terminating near the *Heart*, and Beginning of the *Liver*, and reaching to that Part of the Lungs which made the Great *Bladder*. The *Cartilages* of the *Trachaa*, near the Beginning were ¼ of an Inch, but toward the End of an *Inch*, and lying flattiſh from End to End. Theſe *Cartilages* were not ſo diſtinct as in other *Animals*, but often running into one another.

The *Lungs* begin from the *Throat* and run down 3 Foot in length; the Fig. 205. 6 upper part of them that lay in the fore-part of the Body for the length of a Foot, and did reach to the *Heart*, was made of ſmall *Veſiculæ*, or *Cells*, like the *Lungs* of a *Frog*; but from the frequeut Branchings and Chequer of the *Blood Veſſels* there appeared of a florid red. This Part tapers proportionably to the Body: the loweſt part of it near the Heart, moderately blown, was in Compaſs 5½ *Inches*, a little lower, for the ſpace of 4 *Inches*, the *Cells* gradually diſappeared, ſo that they ſeemed at laſt to form only a *Reticular Compages* of *Valvulæ conniventes* on the inſide of the *Membrane* of the *Lungs*, and the Compaſs of the greateſt Place here, was about 6½ *Inches*, but from thence to the End of the *Lungs*, was only a large *Bladder*, without any *Cells*, compoſed of a thin, but a ſtrong tranſparent *Membrane*, the Compaſs of Fig 2. Secuei which, blown as the former, was 8½ *Inches*.

The *Lungs* of the *Salamandra Aquatica*, and ſome other Animals, are only two large *Bladders*, in the *Frog*, *Crocodile*, *&c.* are two large *Lobes*, fill'd with *membranous Veſiculæ*, or *Cells*. Our *Rattle-ſnake*, and all that Family, tho' they have but one *Lobe* of *Lungs*, yet in that they compriſe the 2 former ſorts; the fore Part being filled with numerous *Veſiculæ*, the latter an entire large Bladder.

In the *Land Tortoiſe* there are 2 *Lobes*, one on each ſide; but theſe are ſubdivided into ſeveral others, according to the Partitions of the Ribs that are fixed to the *Shell*, and they lie chiefly in the *Belly*, that is, the lower Part of the Body. But what I would remark is, that where the *Bronchia* firſt enter theſe Subdiviſions 'tis *Reticulous*, then they form a large Cavity, ſo that in theſe *Animals*, where the *Nixus* of *Reſpiration* is not ſo frequent, Nature provides a ſufficient Store-houſe for this ſo neceſſary a *Pabulum Vitæ*, in theſe larger Bladders, whence 'tis diſpenſed, according to the Exigency of the *Oeconomia Animalis*. For the *Tortoiſe*, *Viper*, *Rattle Snake*, *Frogs*, *Toads*, *&c.* which ſleep a great part of the Year, as before they betake themſelves to this Repoſe, they take in their Store of Food, ſo perhaps that of Air too; a more conſtantly requiſite Supply of Life. For when thus ſtupidly aſleep, and ſometimes to all Appearance dead, it may be queſtioned whether they have any Motion of thoſe Parts, which is required for drawing in freſh Air in Inſpiration. But ſince their Life here is ſo imperceptible and ſmall, this Stock may be ſufficient, the Decay being ſo little. So the *Salamandra aquatica*, that lives under Water, for *Lungs* has two large Bladders, not unlikely for this Reaſon, that it might not be forced ſo often to raiſe it ſelf out of the Water to breathe in freſh Air, when the former is ſpent and decayed.

In a *Viper* I lately diſſected, (which remained alive ſome Days after the *Skin*, and moſt part of the *Viſcera* were ſeparated) I obſerved the Lungs all this while not riſing and falling, as in *Inſpiration* and *Expiration*, but conſtant, equally extended with Air, and that as ſoon as it dyed, it expired and they fell. But the Stomach was empty, and I doubt not was ſo ſome conſiderable time before, as was the *Rattle-ſnakes*, which for 4 *Months* at leaſt had eaten nothing, ſo that altho' they can live ſo long without Food, yet Nature is mighty provident in ſupplying them with Air, in beſtowing on them ſo large Receptacles for receiving it. So the *Ephemeron*, the *Silk worm*, and other *Butterflies*, which all their Life-time, when in that State, do not eat, or take in any Food, yet have their *Bronchiæ* or Lungs remarkably large and numerous; as if they were ſufficient alone for maintaining their Life, for if they be occluded with Oil, or otherwiſe, they are ſtrait ſuffocated, and die convulſed.

The *Oeſophagus*, or *Gula*, which ſerves only in moſt other Animals for tranſmitting the Food into the Stomach, ſeems here to be intended by Nature for ſomething more; for upon blowing up this Part, I obſerved two large Swellings, nor was the true *Stomach* capable of that Extention as theſe were. The whole length of the *Oeſophagus* was 2 Foot 3½ *Inches*; the length of the proper Stomach 5 *Inches*, lying in a ſtrait Line with the *Oeſophagus*, but thicker than it, having a remarkable Coat more on the inſide, eaſily diſtinguiſhable by its Colour, Subſtance, and *Plicæ*, and jetting over the inſide of the *Gullet*, and in all reſpects as in the *Viper*. From the *Pylorus* the *Ductus*, ſtreightned again for 1½ Inch, and then formed a large Inteſtine, which afforded a pleaſant Sight, by the weaved *Rugæ* of its inward Coat, which *Gut*, after ſome ſmall Windings, ended at laſt in the *Rectum*, whoſe Capacity was much leſs than the former. In the Stomach and Guts, I obſerved abundance of *lumbrici Teretes*, which is a Diſeaſe *Vipers* likewiſe are ſubject to. I take the Swellings in the *Gullet* to perform the ſame uſe in theſe Animals as the *Crop* in Birds, and the *Paunch* in *Quadrupeds*; they being convenient Receptacles for retaining what Food the Stomach cannot yet well receive; and here it ſeems the more requiſite, ſince they feed but at one time of the *Year*. And ſince in that promiſcuous Food they take in, which they ſwallow always whole, there are often ſome Parts unfit to be digeſted, and therefore to be returned again, the *Gullet* here being very long, and upon that Account incommodious for this Action; Nature has provided theſe Swellings in it, where they may be reſpited, till recruiting its Force, it gives them another Lift, and upon a third Effort, at laſt wholly ejects them. And if what is confidently reported by many be true, that on Occaſion of Danger, they receive their Young into their Mouths, theſe are fit Places for Receiving them.

Fig, 205. df

Fig, 205. g

Fig. 206. eee

Fig 206. ff

The Food before it can prove *Aliment*, muſt be comminuted, and broken into the ſmalleſt Particles, which in theſe membranous Stomachs, I cannot ſee how it can be performed, but by Corroſion. A Principal Menſtruum in doing this, I take to be that Liquor, which is diſcharged by the *Glands* that are ſeated, in ſome at the Beginning of the *Throat*, and are called *Salival*, or juſt above the Stomach or Gizzard of Birds, and called the *Echinus*, or in others in the *Stomach* it ſelf, and called the *Glandulous Coat*, and ſuch I take the *Inward Coat*, of the *Stomach* of our *Rattle ſnake* to be. When

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Comminuted 'tis diſcharged into the Guts, which, that the *Chyle* might not paſs off with the *Fæces*, are often Convoluted, or Winding, as here : that Fig. 206. oo, ſo by impeding a too quick Deſcent of it this Way, or by *Valves*, a Separation may the better be made; and then the *Fæces*, as uſeleſs, cannot quicker be diſcharged than by the *Rectum*; which where the *Fæces* are Hard, is furniſhed with a ſtronger *Muſcle*, the better to help its Action; and ſuch ſeem'd the *Rectum* here, and the Fæces harder than uſual in Vipers.

The *Heart* was placed near the bottom of the *Trachæa*, on the Right ſide Fig. 205. k. of it. The Length of it was 1½ *Inch*, Its Figure rather flat than round; encompaſſed with a *Pericardium*, and the *Auricle* larger than the *Heart* it Fig. 205. l. ſelf. It hath but one *Ventricle*, the *Valves* ſmall and fleſhy, and the inſide of the *Ventricle* diſtinguiſh'd by 4 or 5 croſs Furrows. Why *Charas* ſhould make the Heart of the *Viper* to have two *Ventricles*, I ſee no Reaſon, I ſhould much more eaſily allow a double Auricle, one at the Entrance of the *Vena Cava*, of which there are two Branches deſcending, and one aſcending; the Fig. 205. nnn other for the *Arteria Aorta*, which has two aſcending and one deſcending. Fig. 205 mmm

A little below the Heart lies the Liver, which was about an *Inch* wide, in the largeſt Place, and ſeem'd divided on one ſide by the *Vena Cava* into Fig. 205. oo. 2 *Lobes* of an unequal length; for that on the left Side was about Ten Inches, and that on the right Side about a Foot long. Its Colour was a brown red, and its uſe, no Doubt, for the ſeparating the *Gall* that was contained in a Bladder ſeated at ſome Diſtance below it. This *Gall-Bladder* was two Inches long, the Colour of the *Gall* contained in it a Graſs-green, which Fig. 205. p. ſweating through its Coats, had deeply tinged all the adjacent Parts; the *Taſte* of it, in a *Viper*, which ſeems the ſame, for I did not taſte it here, was firſt ſalt, than a ſweet-bitter. The *Ductus* which brings it from the *Liver*, is obſcure, and hard to be found : But the *Ductus Cyſticus* by which it empties it ſelf into the Inteſtine is evident enough. It ariſes from the top of the Bladder; ſo gently deſcending, paſſes through that part which *Charas* takes Fig. 205. d. for the *Pancreas*, but which the *Ancients* call'd the *Spleen*, and ſo enters the beginning of the large Inteſtine. In *Vipers* indeed, the Colour of this Part, and Situation ſo near the *Inteſtine*, ſeems an Argument for *Charas* his Conjecture; but here its Colour, which was deep red, and ſuch hitherto I have obſerved the *Pancreas* to be in no other Animal, as likewiſe its Figure, not ſpreading, but more compact, ſeem to favour the Opinion of the *Ancients*. I have only this to ſay of it, that it was about the bigneſs of a large *Bean*, that it had adhered to the Side of the inteſtine at the Beginning of it, and that through the middle of it, as is already obſerved, the *Ductus Bilarius* did paſs.

The Fat which was very plentiful, is ſaid to be uſed by the Phyſicians of *Mexico* with good ſucceſs in the *Sciatica*, and all Pains of the *Limbs*, and for diſcuſſing *Preternatural Tumors*. The *Membrane* it adhered to, I take for the *Omentum*, which encompaſſed all Parts contained in this lower Belly;

and was joined to both ſides of the *Ribs*, ſo running to the *Rectum*, and forming a Bag that inveloped the Parts here, but was free and not conjoined towards the *Belly*. The lower Belly I call it, to diſtinguiſh it from the reſt of the Trunk, for the whole was but one continued *Cavity*, there being no Partition of it by any *Diaphragm*.

Fig. 206. The *two Kidneys* which lay to the Back on each ſide of the *Spine*, but not very firmly conjoined, were about 7 *Inches* long, that on the right ſide ſomething longer than the left, and about ½ *Inch* broad each; And though the Subſtance of it ſeems one continued Body, yet it is plainly diſtinguiſhable into ſeveral leſſer *Kidneys*, for they ought to be reckoned as many as there are diſtinct Syſtems and Orders of *Veſſels*, which, according to the Advantage of the Body of this *Animal*, are placed at length, not piled on one another. As I remember, in one of the *Kidneys* I numbred 25, all very curiouſly contrived, and with an inexpreſſible Beauty. When they were firſt taken out of the Body, the whole ſeemed a delicate Compages of *Veſſels*, and the Intermixture of thoſe of the Blood with thoſe other white ones, that are the *Secretory*, compoſed moſt regularly formed Bodies. In the Figure, that on the left Side repreſents the upper Superficies of the *Kidney*, which appears firſt in the *Diſſection*; the other, the lower ſide which lies to the *Back*: in both there are two large Blood Veſſels running down each Side, one marked *nnn*, the other, where the *Vas deferens* runs, but is not here repreſented, and from theſe ariſe ſeveral leſſer Branches, *ooo* at ſet Branches, which curiouſly ſpreading themſelves do form, as it were, *Ramifications* of Trees. As many as there were of theſe emulgent Veſſels (for ſo I take them to be) ſo many Kidneys were in each; the Interſtices, *ppp* of theſe Blood Veſſels, were filled up with other white ones, which I doubt not are for the *Secretion* of the *Urine*, and on this ſide did appear more numerous than on the other. But 'tis impoſſible to repreſent the curious Interweavings of both; but here in the under-ſide of the right *Kidney*, in ſome places they appeared more diſtinct; for *QQ* ſhews the large *Blood Veſſel*, whence ariſes the *Emulgents*, *rrr* which ſpreading themſelves very thick into the Bodies, *sss* make them appear all bloody; between which for a little Space, there appears a ſmall Body of the *white Secretory Veſſels*, *ttt*. The uſe of this Part, in all *Animals*, is for carrying off the *Lixivial* and ſuperfluous *Serum* of the Blood, which is of ſo great Conſequence, that even thoſe Animals that drink not at all, or but very little, yet by Nature are furniſhed with them; as the *Rattle Snake* may be thought. When the Separation of this Humour is made in the Kidneys, 'tis conveyed thence by the *Ureters* into a Bladder, if the too frequent Excluſion of it might be inconvenient to the Animal; or, if it be made in leſſer Quantity into a *Cloaca*, juſt at the *Anus*, and ſo to be ejected.

Fig. 206. uu The *Ureters* did run almoſt the Length of the Kidneys, being a common Trunk that received the leſſer Branches, that went to each ſingle Gland, and did terminate near each other in the *Cloaca*, making a Riſing there; for our *Rattle Snake*, like *Birds*, had a *Cloaca*, which in the Female *Viper*, receives the Orifices of the *Ureters*, and the two *Uteri*, and in part may be ſaid that of the *Rectum* too, which had a *Connivent Valve* that covered it.

Near the Verge of the *Cloaca*, we obſerved two other Orifices, which ſeemed covered by the folding of the Skin, and theſe led into thoſe two *Bags* which I have taken the Liberty to call the *Scent Bags:* One of them was about an Inch long, and as big as a Gooſe-Quill, but Taper towards the End, and from the Colour of the Liquor it contained, appeared Darkiſh: The other *Bag* was ſomething leſs, and its Colour as in the *Viper*; this Difference, I ſuppoſe, may be Accidental. The *Liquor* included in them was ſomething Craſs, and of a ſtrong and very unpleaſant ſmell; ſuch, but in a more Intenſe Degree, as the Animal did Emit before Diſſection. Fig.205.mm

I ſhall here add, that our *Common Snake* emits a far greater *Fætor* (which lies in the ſame *Bags*) than our *Adders* or *Vipers:* And I have been told by Travellers, that ſome *Crocodiles* will leave a ſtrong, but grateful Smell behind them, which, if ſo, I doubt not but it may be upon the ſame Cauſe.

But uſually, tho' this Liquor when new, and in great Quantity, be Offenſive, and of an Ill Smell, (and ſuch is *Civet* likewiſe, which is nothing elſe) yet when dry, and in leſſer Proportions, it may prove more grateful.

Thus the *Liquor* in the *Scent Bags* of a *Weaſel* being dryed on a Paper, and kept ſome time, did not ſeem unpleaſant to me; but rather the contrary: And I ſee no Reaſon why *Pole-Cats* may not be *Civet-Cats*, though they may not turn to that Account. But in a Lyon I Diſſected, the Liquor contained in the *Scent-Bags* was, in the Opinion of all that Smelt it, much like that of Oil of *Aniſe*, or Fennel-Seed; which was almoſt the only Difference I could find between the *Lyon* and a *Cat*; for in a *Cat* this Liquor is Ill Scented.

The *Teſtes* are very Unproportionate in Length, the Right being 2¼ Inches long, the Left 1¼ Inch long, ſcarce ſo big in Compaſs as a Gooſe Quill. Fig.206.bb The unequal length of this Part *Charas* takes notice of in Vipers; and I ſhall add, that the *Ovarium* of the Female Viper is the ſame; for that of one ſide was as big again as the other. The Colour of the *Teſtes* was White, as is uſual, and ſo was their Subſtance. The *Vaſa Præparantia* had nothing uncommon: But the *Deferentia* were Remarkable, for though they did run in Fig.206.ii a ſtraight Line almoſt from the *Teſtes* to the *Penis*, and did form no large Body, yet this *Ductus* was ſo often Involuted, that were it unravelled and extended its whole length, 'twould be twice as long; which made me think that it was only the Extenſion of the *Epididymis*; for the whole *Teſtes* is but a *Congeries* of curiouſly Convoluted Veſſels which terminate in the *Epididymis*, whoſe Continuation makes the *Deferens*. And where its *Convolutions* are many upon the Body of the *Teſtes* it ſelf, there the *Deferens* is an even *Ductus*: But as in our Subject it making no ſuch Body there or but a very ſmall one, in its Paſſage downwards it was every where Fig. 207. a. Crimpled, and about the middle of the *Kidneys* often Convoluted. Upon the Diſſection of a Viper, I have ſince found that they were continued along the *Penis*, Single where the *Penis* was ſo, and afterwards divided, and did run to the end of each: Nor, were there any *Veſiculæ Seminales* or *Proſtatæ* here to receive them.

Fig. 206. kk. There were four *Penes*, two on each ſide, which lay Sheathed in the Body: ſo that upon firſt opening it they were not perceived, but only the large *Orifices* where they were drawn in as a Finger of a Glove may be by a Thread faſtened to the end. But having protruded them by a *Probe*, they appeared as is repreſented in the Figure. And I did obſerve that towards the *Baſis*, or Root they were ſingle of each ſide, and that here they were thick beſet with Prickles, whoſe Points looked backwards, and were very ſharp, and ſeem'd, eſpecially when dry, like the Subſtance of the *Briſtles* of a *Hedge-Hog*: but hence they were divided, and did Form two round Bodies of the bigneſs of a ſmall Gooſe Quill, about ¾ of an Inch long, of a Red Colour, but the whole, as protruded, was above an Inch long. When protruded I found they could eaſily be retracted, and drawn in by the help of large Muſcles, that were faſtened to them and did run along under, and were at laſt inſerted at the end of the Tail at the ſetting on of the firſt *Rattle*; which upon the Trial was ſo plain that we needed not doubt of the uſe of them, and I ſhall therefore call them *Retractores Penum*. There are ſeveral Animals that have no *Penis* at all, but *Vaſa Deferentia*, as moſt Fiſhes. All *Quadrupeds* that I know of have but a Single one. Some *Birds* have but one. Moſt others, if they may be ſaid to have any, have *two*, but very ſhort. In *Crabs*, *Lobſters*, *&c.* there are *two* long ones, one on each ſide: but *Earth-worms*, *Leeches*, *Shell-ſnails*, *&c.* are *Hermaphrodites*, and have the perfect *Organs* of both Sexes. But where the Sex is ſingle, the *Rattle-ſnake* and that Family have theſe Organs of Generation the moſt Numerous of any I have hitherto met with. But why the *Male Rattle Snake*, or the *Male-Viper*, ſhould have four Penes, when the *Female* has but *two Uteri* for receiving them, ſeems a difficulty to me. Amongſt many Conjectures I have had about it, what ſeems the moſt to ſatisfy me, is this; That they have the Penis here on each ſide double, or Forked, that ſo being entered the *Uteri*, by ſpreading themſelves like the *Pythagorean* Y. they may the better and more firmly be retained there till they have performed their Duty. And this too ſeems one uſe of the *Aculei*, or *Briſtles*, towards the Root of them; for having their points looking *backwards* when once they have entered the *Pudendum*, they muſt needs Lock them in, and retain them there, till ſuch time as the parts being tired, and Subſiding, have leave to Retreat. For in *Animals* that have no *Veſiculæ Seminales* 'tis requiſite that the *Coitus* be long, that ſo the Seed which cannot quickly, may leiſurely, be tranſmitted from the *Teſtes*; but where 'tis beforehand ſtored up in the *Veſiculæ*, there the *Coitus* is ſoon over; but when they muſt expect the *Generation*, or at leaſt a ſluggiſh Deſcent of it, Nature makes Proviſion for the more convenient performing it. So in Dogs, which have no

Veſiculæ Seminales, near the *Root* of the *Bony Penis* there is a large Body made up of an abundance of Cells and Veſſels: which upon the Ruſhing in of the Blood and Spirits, is ſo mightily extended and Swelled, that it forceably keeps him in, till ſuch time as the *Impetus* be over, and the part Subſides. So the *Lump-fiſh* on it's Breaſt has a large round Body curiouſly contrived, like the *Tail* of a *Leech*, or the *Acetabulum* of the *Polypus*, by which it can firmly adhere to the Females, and ſo by this means, tho' its *Penis* be very ſhort, yet be able to perform a *Coitus*. *Cats. Lyons, &c.* which have likewiſe very ſhort *Penes*, that they may the better Cling, are forced to make uſe of their Teeth and Claws, and from the Pain of theſe, not from the Scalding of the Seed, come thoſe fierce Scrieks and hideous Yowlings. Therefore in our *Rattle Snake*, (where, as we have obſerved, there are no *Veſiculæ* and where the *Vas Deferens* is all along Crimpled and Winding, and ſo upon both Accounts muſt be thought to be long in *Coition*) the Contrivance and Structure of theſe Parts ſeem very Requiſite. For altho' in this Action they Twiſt their Body, which may be ſome Advantage too, yet not ſufficient alone: for otherwiſe upon a little occaſion the Parts would be apt to ſlip out, which now they cannot, being Forked and Hooked in too by the *Aculei*, or *Briſtles*. But the *Deferentia* being continued to the end of the *Penis* do likewiſe ſhew this muſt be the uſe of them. But that the Female may receive no Injury by theſe *Spines*, Nature has made that Part of the *Uteri* which they enter, ſtrong and griſtly; as we obſerved in a Viper; and that the Male too might not be harmed by an over Extention of theſe Parts, thoſe ſtrong *Muſcles*, which ſerve for Retracting and Drawing them in, do likewiſe ſecure them in this reſpect too. It may be likewiſe conſidered, ſince they are naturally ſo Cold and *Frigid*, whether theſe *Aculei* may not ſerve to Incite them, and ſtir them up.

The Head was but ſmall, yet the *Rictus* was very large. The Tongue Fig. 10. g
in all reſpects like that of a Viper, was compoſed of 2 long round Bodies, Contiguous and joyned together from the Root ⅔ of its length, with great Agility they could dart them out, and Retract them again; and that part which appeared out was of a Black Colour, whereas that which lay Sheathed within was Red; for 'twas faſtened below the Throat, and thence was covered with a *Vagina*, or Sheath to the place where it Iſſues out, which was near to the end of the *Larynx*; and for the better Ejaculation of it, the under Jaw too was here divided, leaving a conſiderable ſpace.

For if it were conjoyned as in other Animals and beſet with *Teeth*, they Fig. 10. d
would be apt to Injure the *Tongue*; or at leaſt it might prove incommodious to the uſe 'tis deſigned for, which in part I ſuſpect with *Charas* to be for catching Flies, and ſuch ſmall Creatures, they have a mind to devour.

Over the *Tongue* did lie the *Larynx*; not formed with that Variety of Fig. 10. f
Cartilages as is uſual in other *Animals*, but ſo as to make a *Rima*, or *Slit*, for Receiving or Conveying out the Air. Nor was there any *Epiglottis* for

preventing other Bodies from ſlipping in; this being ſufficiently provided for, by the ſtrict Cloſure of them: And the Air paſſing only through ſuch a ſlit, without the Contrivance of other Parts for Modulating it, can only make ſuch a Sound as we obſerve in their Hiſſing.

Fig 209 cc h The *Teeth* are of two ſorts. 1. The Leſſer which are ſeated in each Fig. 209 dd Jaw, and ſerve for the Catching and Retaining the Food. 2. The Poy- Fig. 210 h ſonous Fangs which kill it, and are placed without the upper Jaw. Fig. 211 They are all *Canini*, or *Apprehenſores*: for ſince they do not Chew or Bruiſe their Food, but Swallow all whole as they meet with it, there is no need of *Molares*. Of the firſt ſort of *Teeth*, in the lower Jaw there are two Rows on each ſide; five in a Row, the inward leſſer than the outward, ſo that Fig. 210 g there are here twenty in all. In the upper Jaw there are but ſixteen, five on each ſide placed backwards, and ſix before: theſe do no harm. The Fangs Fig. 210 f are placed without the upper Jaws, towards the fore part of the Mouth, not faſtened to the *Maxilla*, as the other *Teeth*: but the two outmoſt and largeeſt Fangs were fixt to that Bone, which, if any, may be thought to be the *Ear bone*. The other Fangs I could not perceive were faſtened to any *Bone*, but to *Muſcles* or *Tendons* there. Theſe Fangs, or larger *Teeth*, were not to be perceived upon firſt opening the Mouth, they lying Couched under a ſtrong Membrane or Sheath; but ſo as did make a large Riſing there on the outſide of the leſſer *Teeth* of the *Maxilla*; but at pleaſure when alive they could raiſe them to do Execution with; not unlike as a Lyon or a Cat does it's Claws. Theſe *Teeth* were hooked and bent like the *Teeth* of a *Barbaroſſa*: but ſome of the ſmaller of them were bent at *Right Angles*. On each ſide we met with about ſix or ſeven, but not placed altogether ſo exactly as in the Scheme. In all theſe *Teeth*, eſpecially the larger, we took notice of a pretty large *Foramen*, or hole, towards the Root of it, and towards the Point there was a plain viſible and large Slit, like the cut of a Pen ſlopping; and that part from the ſlit to the Root was perfectly hollow: which firſt of all was diſcovered to us, by preſſing gently with our Finger the ſide of the *Gum*; for then we did perceive that the Poyſon did readily ariſe through the Hollow of the *Teeth*, and iſſued out of the ſlit.

This Poyſonous Liquor I obſerved to be of a *Water* Colour, lightly tinged Yellow. What the Poyſon of Serpents is, and how it produces its Dire Effects, has been of late Conteſted between S. *Redi* & M. *Charas*. 'Tis *Redi*'s Opinion, that the Yellow Liquor contained in the *Veſicles* of the *Gums* of *Vipers*, is the only and true ſeat of the Poyſon; that this Juice is not *Venemous*, when taken in at the Mouth; but that it is ſo when let into Wounds, whether it be uſed when Liquid, or after it is dryed. But M *Charas* wholly oppoſes this, and Aſſerts, that the *Poyſon* is no where but in her *Inraged Spirits*; and that this Yellow Juice is nothing but a meer *Innocent Saliva*.

But the Fabrick of the *Teeth*, (they being thus Hollow, and having that large ſlit towards the end, and this Juice ſo readily and naturally iſſuing through them) ſeems to me to Argue, that Nature Deſigns it for other uſes than Nouriſhment; for if ſo, by giving them ſo large a Vent ſhe would be fruſtrated of her end. But they being ſo ſharp and ſtrong at the Ends, and the Slit too placed towards the back, not inſide of the *Tooth*; what can be more conveniently contrived both for making the Wound, and infunding the Poiſon? For if the Slit was inwards, by the ſtruggling and withdrawing of the *Animal* aſſaulted, the Slit would be apt to be ſtopt, and Occluded; and the deſcent of the Poiſon prevented: But being thus formed, it gives a greater Advantage for its *Infuſion*. Thus the *Scorpion*, the *Bee*, the *Emmet*, nay the *Sting* of a *Nettle*, at the ſame time they make a Wound, they leave behind them a drop of Liquor, which excites thoſe dreadful *Symptoms*: Whereas the Wound without it, would be inconſiderable. And what has ſome Weight with me, (contrary to the Sentiments of M. *Charas* of the Innocence of this Liquor) is a Relation I had from an intelligent and knowing Perſon, who informed me that being in the *Indies*, there came to him and his Company an *Indian* with ſeveral ſorts of Serpents, and offered to ſhew them ſome Experiments about the force of their Poyſon, and the difference of them; and that his Practice is common with them. Having therefore pull'd out a large one, the *Indian* told him that this would do no harm; therefore making a *Ligature* on his Arm, as they do in *Letting Blood*, he expoſed it naked to the Serpent, having firſt whipt and irritated him to make him Bite it. The Blood that came out of the Wounds, made by his *Teeth*, he gathered with his Finger, and laid in on his naked Thigh till he had got near a Spoonful. After this he takes out another call'd *Cobras de Cabelo*, which was leſſer, and inlarges much upon the greatneſs of its Poyſon; and to ſhew them in part an inſtance of it, graſping it about the Neck, he expreſſes out ſome of the Liquor in the *Baggs* of the *Gums* about the quantity, as he thought, of [illegible] a Grain, and this he puts to the Coagulated Blood on his Thigh, which as ſoon as mixt with it ſtraight put it into a great Fermentation, and Working like *Barm* changed it into a Yellowiſh Liquor. The ſame has been likewiſe obſerved by others, and does ſeem to give us ſome Light, how 'tis that this Poiſon Acts, and confirms the known Obſervation, that the biting of a *Viper* will cauſe the *Yellow Jaundice*. A preſent Antidote for this Poiſon is ſaid to be the Snake Stone; *Pierre de Cobras de Cabelo* 'tis call'd by the *Portugueſe*, and is Famous all over the *Indies*; 'tis deſcribed by *Garcias ab Horto*, by *Kircher* and others, particularly by Senior *Redi*, who renders very much ſuſpected the Relations that are commonly had of its great Force and Virtue; But that it does not always fail ſome Accounts I have had of Perſons relieved by it here in *England*, have convinc'd me. One inſtance is Remarkable that was told me by an Eminent Phyſition in *London*, of a Perſon near the Town that was bit by a *Viper*; his Hand and Arm ſoon ſwelled with great Extremity of Pain: But upon the Application of this Stone for one Night both were Aſſwaged, and he thought himſelf well, and took off the Stone, which did ſtill firmly adhere. But not long after his former *Symptomes* violently returning, he had recourſe to his *Antidote*, and then ſuffered it to continue there till it fell off it ſelf,

Vid. inf. [illegible] XLVIII.

and ſo was Cured. One Tryal I formerly made my ſelf, in a Patient troubled with the *Gout* in her *Stomach*; having removed it thence, it ſeiz'd her *Toe*: but ſhe being impatient of the Pain, that I might ſeem to do ſomething, and to hinder her uſing abundance of Medicines, which every Body was like to adviſe her to, and might be apt to ſtrike it to her Stomach again, I thought of this; holding the Stone therefore in my Hand, and without acquainting her I put it near the Joynt where her Pain was moſt; and being very near it, I perceived it move out of my Hand, and readily adhere to the Part. Soon after ſhe acquainted me, that ſhe very ſenſibly perceived a great drawing and trickling all down her Leg and Thigh, and afterwards owned an Abatement of her Pain. In *Peſtilential Swellings* very probably it may be of uſe.

Amongſt the Bones of the Head, I obſerved that the *Cranium* here was
Fig. 210: a. entire, and without Sutures: only where ſome other Bones were joyned to
them; as forwards over the Noſtrils were two ſmall Bones; to which were
Fig. 210, cc. d. faſtened the *Cartilages*, or rather *Bones* which divide the *Noſe*. The other
Bones ſeemed admirably contrived for the great Extenſion, and widening
of the *Maxilla*: Which ſeems a great Proviſion of Nature; for ſince it muſt
ſwallow all things whole, and its Head is but ſmall, without this moſt *Mechanical* Contrivance it were impoſſible to do it. The upper Jaw forward
was joyned to the *Bone* that receives the Poiſonous *Fangs*; and which had a
Fig. 209. b. large *Cavity* in it, which opened outward, and was thought to be the *Foramen* of the *Ear*: but inwards we obſerved no Perforation for a *Nerve*, unleſs there might be one that comes to it under that *Bone* which conjoyns
Fig 210. aa. it to the *Cranium*. This *Articulation* ſeems Advantageous, both for the *Motion* of the *Fangs*; which lie ſometimes Couched, ſometimes Erected, as of
the Jaw too: but its Principal and moſt Remarkable Advantage for ſwallowing large Bodies, is the Curious *Articulation* of the *Maxilla* backwards
to the *Cranium* by 2 *Bones*, which from their uſe (ſince we know no Name
Fig. 210. n. o. to diſtinguiſh them by) we ſhall call *Maxillarum Dilatores*. Their ſhape,
bigneſs, and aptneſs for this Motion will readily enough be conceived by
the *Eye* in obſerving the Figure. For the lower Jaw being not conjoyned at
the *Mentum*, as is uſual in other Animals, but Parted at a good Diſtance;
upon the receiving a large Body, as the *Membrane* here to which they are
faſtened eaſily extends, ſo by lifting up, as alſo by bringing theſe 2 *Bones*
more to a ſtraight Line, it muſt needs conſiderably widen the *Rictus* of the
Mouth: and for this Cauſe too they are made two, not one, for performing
this Motion more eaſily. This *Articulation* of the *Dilatores*, which is very
Curious, with the upper and lower Jaw, makes thoſe *Protuberances* of the
Fig. 210. m. *Head*, which we likened to that of a Bearded Arrow. The lower Jaw of
each ſide was Compoſed of two *Bones*, as appears in the Figure, but firmly
Fig. 210. kk. conjoyned. The Fore *Bone* was for receiving the ſmall *Teeth*, the hinder
towards the *Articulation* grew broad; as likewiſe did the *Bone* of the upper
Jaw anſwerable to this place in the lower. But this upper Jaw, towards the
Fig. 210. ii. *Poyſonous Fang* divided into two *Bones*; one was faſtened to the *Bone* of the

Poyſonous Fang outwards; the other, which received the ſmall *Teeth*, was inſerted into the ſame *Bone* more inwards.

The *Vertebra*, according to the whole Figure of the Body, were ſmalleſt towards both Extreams, and largeſt in the middle. From the Neck to the *Anus* there were as many obſerved as *Scales* on the *Belly*, *viz*. 168. but from the *Anus* to the ſetting on of the *Rattle*, 29 more in Number than the *Scales*.

The former *Vertebra* had a flat upright Spine towards the Back; and a *Fig.*212. *a. b* ſlender round Oblique deſcending one inwards to the Belly. To each *Vertebra*, beſides thoſe Spines juſt mentioned, there were other *Proceſſus*'s for the advantage of ſetting on of the Ribs, and the *Articulation* with one ano- *Fig.*212. *c. d* ther: But what was moſt remarkable the round Ball in the lower part *Fig.* 212, *e.* of the upper *Vertebra*, which enters a Socket of the upper part of the lower *Vertebra*, like as the *Head* of the *Os Femoris* does the *Acetabulum* of the *Os Iſchii*; by which Contrivance, as alſo the *Articulation* with one another, they have that free Motion of Winding their Bodies any ways. The Ribs in the Neck were ſmall, but laager towards the middle of the Body, where they were about 2 Inches long; but towards the Tail *Fig.* 213. *b b* they grew leſſer and ſhorter again; and did all Terminate at the beginning of the Scales of the Belly. In the *Vertebra* of the Tail inwards there were 2 Spines: Whereas in the other *Vertebra* there was but one; as likewiſe there wereihere Tranſverſe ſlender *Proceſſus*'s ſomething Analogous to Ribs.

To the laſt *Vertebra* of the Tail was faſtened the *Rattle*; in our Subject *Fig.* 11, 12 there was but five, but ſome others ſeemed to be broken off. That next the Tail was of a Lead Colour; the others, of a *Cinericious*. 'Tis well deſcribed by Dr. *Grew*, in his *Muſæum Reg. Soc.* This *Rattle*, according to *Gulielm. Piſo* (and I know no other uſe of it) was given by Nature to this Pernicious Animal, *ut illius* Sonitu *admonitus quilibet Homo non ſolum, ſed & qualecunque pecus, vel Jumentum, tempeſtive ſibi Caveat a vicino Hoſte.* Some Authors *Muſ. R. S.* p 51. aſſert, that every Year there is an Addition of a new *Rattle*; which Dr. *Grew* ſuſpects, for then he muſt live 16 Years; for ſo many Joynts there are obſerved in ſome in our *Repoſitory*; I have been told, in ſome there have been above 20. Theſe *Rattles* are placed with their broadeſt part Perpendicular to the Body; not *Horizontal*. And the Firſt is faſtened to the laſt *Vertebra* of the Tail by means of a thick *Muſcle* under it; and by the *Membranes* that conjoyn it to the Skin.

Fig. 205. Repreſents the upper part of the Body opened, *aaa*. The *Aſpera* **Explication** *of the* **Figures,** *Deſigned by* **Mr Rich. Waller, ib. p.55** *Arteria. B.* The upper part of the Lungs, which is *Veſiculous. c c c c c.* The lower part of *Lungs*, which makes a large *Bladder. d.* The Firſt Swelling of the *Oeſophagus*, or *Falſe Stomach. eee.* The *Oeſophagus, or Gullet*, and that part of it where 'tis Streighter. *f.* The *Second Swelling* of the *Oeſophagus*, or *Second Falſe Stomach. g.* The *True Stomach. h.* A ſhort ſtreightning of the *Gut*, a little below the *Pylorus. i.* The *Inteſtines, k.* The *Heart. l.* The *Auricle. mmm. Three Arteries*, whereof theſe are two *Aſcending*, and one *Deſcending. nnn. Three* large *Veins*, whereof two are *Deſcending*, and the third

Aſcending; which laſt does ſeem to divide the *Liver* into two *Lobes*. *oo*. The *Liver p*. The *Gall Bladder q*. The *Spleen*, as 'tis call'd by the *Antients*; but by *Charas*, the *Pancreas*. *r r r*. A large *Blood-Veſſel* that runs in the midſt of the *Scales* of the *Belly*. *s s*. The *Muſcles* belonging to the *Scales* of the *Belly*.

Fig. 206. The Parts contained in the lower part of the Body *a a a*. The *Inteſtines b*. the *Gall Bladder c*. the *Ductus Bilarius*, that paſſes through the middle of the *Spleen*, or as called by *Charas*, the *Pancreas*, and enters the large *Gut d*. the *Spleen*, or *Pancreas ee*. the *Inteſtines*, which were very large and winding, but ſhort *f f*. the *Rectum g*. the *Anus h h*. the *Teſtes ii*, *ii*. the *Vaſa Deferentia k k*. the *Penes* on each ſide which firſt at the Root are Conjoyned, and are thick beſet with *Briſtles l.l*. the *Muſcles* that ſerve for the drawing in the *Penes m m*. the *Scent Baggs n n*. A large *Blood Veſſel* that runs on one ſide of the *Left Kidney o o*. the *Emulgents* that ariſe from the ſame, *p p p*. the *Secretory Veſſels QQ*. the large *Blood Veſſels* of the *Right Kidney*, *r r r*. the *Emulgents* ariſing from it, *s s s*. A round Body of *Blood Veſſels*, *ttt*. *Secretory Veſſels*, *u u*. the *Ureters*.

Fig. 207. The *Penes* of one ſide of a *Viper*, *a*. the *Vas Deferens*, which afterwards Divides, and runs to the End of the *Penes b*. the *Penes*, *c*. the *Muſcle* which *Retracts* the *Penes* in.

Fig. 208. The *Lungs* open'd by the *Trachea*, *a a a a*. the *Arteria Aſpera*, divided in the middle *b b b*. ſome larger Branches of *Blood-Veſſels c c c*. the *Veſicula*, or *Cells*, of the *Lungs*.

Fig. 209. The Head, with its Mouth open'd, *a*. the Hole of the Noſtril, *b*. the *Foramen* which leads to a large *Cavity*, which has no *Perforation* for any *Nerve* inwards: but yet 'tis thought to be for Hearing *c c*. the ſmall *Teeth* in the upper Jaw, *d d*. the large Fangs, or Poyſonous *Teeth*, *e e e*. the Place where the Bladders of Poiſon lie, *f*. the *Larynx*, *g*. the *Forked Tongue*, *h*. the *Teeth* in the lower Jaw, *i*. the place where the lower Jaw is divided at the *Mentum*.

Fig. 210. The *Scull*, *a*. the *Cranium*, without any *Sutures*, *b b* the *Orbits* of the *Eyes c c*. two ſmall Bones over the Noſe, *d*. the Griſtly, or rather Bony *Sepimentum* of the Noſe, *e e*. A ſmall Bone, that lies between the *Cranium* and that Bone in which is fixed the Poyſonous Fangs, *f f*. A *Cavity* in that Bone, to which is faſtened the Poiſonous Fang, whoſe outward Orifice is repreſented in Fig. 209. by the Letter *b*. and is thought to be the Ear, *g*. the large Poiſonous Fang, which is faſtened to the Ear Bone, *h*. the other Poiſonous *Teeth*, which are not fixt in the Bone, but to *Muſcles*, *ii*. the upper *Maxilla*, which contains the ſmall *Teeth*, *k k*. One ſide of the lower *Maxilla*, with its double Row of *Teeth*, which in the middle ſeems to be joyned by a *Suture*, *l*. the diſtance at the *Mentum*, between the two ſides of the lower *Maxilla*, or Jaw, *m m*. Where the two *Maxillæ* are joyned together backwards, and by a *Tendon* are faſtened to another Bone, which from its uſe, and for Diſtinctions ſake, we call *Dilatores Maxillarum n n*. the *Dilatores* of the Jaws, *o o*. A ſhort Bone which Joyns the *Dilator's* to the *Scull*, or *Cranium*, *p*. the *Vertebra* of the Neck.

Fig. 211. The Poiſonous *Teeth.*

Fig. 212. One of the *Vertebræ* of the Back, *a.* the outward Spine, of the *Vertebra*, which is flat longways, *b.* the inward Spine of the *Vertebra* which is round, *c.* A large flat *Proceſſus*, for the *Articulation* of the *Vertebræ*, *d.* ſmall *Tranſverſe Proceſſus*'s for the ſetting on the Ribs, *e.* A round Ball, like the Head of the *Os Femoris*, which enters a Socket of the lower *Vertebra*, as that does the *Acetabulum* of the *Os Iſchii.*

Fig. 213. One of the *Vertebræ* of the *Tail*, *a.* the Spine towards the Back, *b b.* the two inward Spines, *c c.* the Tranſverſe Spines, Analogous to Ribs.

Fig. 214. The *Vertebræ* of the *Tail*, and the *Muſculous Fleſh* which faſtens the Firſt *Rattle*, *a.* the *Vertebra*, *b.* the *Muſcle* on which is faſtened the *Rattle.*

Fig. 215. A Single *Rattle*, which has three Joynts: the firſt and largeſt appears when Conjoyned with others, the two other ſerve for the faſtening on the ſucceeding *Rattles*, and are covered by them.

Fig. 216. The Five *Rattles* as joyned together.

XLIV. The *Wild-penny-royal* or *Dittany* of *Virginia*, groweth ſtraight up about one Foot high, with the Leaves like *Penny-royal*, with little Blue *Tufts* at the joyning of the Branches to the Plant, the Colour of the Leaves being a *Reddiſh Green*; but the *Water Diſtill'd*, of the Colour of *Brandy*, of a Fair *Yellow*: The Leaves of it Bruiſed are very hot and biting upon the *Tongue*. Of theſe Leaves ſo Bruiſed we took ſome and having tyed them in the Cleft of a long Stick, we held them to the Noſe of the *Rattle Snake*, who by turning and wriggling laboured as much as ſhe could to avoid it: But ſhe was kill'd with it, in leſs than half an Hour's time; and, as was ſuppoſed, by the Scent thereof. This was done *A.* 1657 in *July*, at which Seaſon thoſe Creatures are reputed to be in the greateſt Vigour for their Poiſon. It is alſo remarkable that in thoſe Places where the *Wild-penny royal* or *Dittany* grows, no *Rattle Snakes* are obſerved to come.

A Way of killing Rattle Snakes, *By Capt.* Silas Taylor, n. 3. p. 43

n. 4. p. 75

XLV. There is this Difference betwetn the *Brooding* of *Snakes* and *Vipers*; the *Snakes* lay their Eggs in Dung-hills, by whoſe Warmth they are Hatched: but the *Vipers Breed* their Eggs within their Bellies, and bring forth *Live Vipers.* To which may be added, that ſome affirm to have ſeem *Snakes* lie upon their Eggs, as Hens ſit upon theirs.

The Brooding *of Snakes and* Vipers, *By* n. 8. p. 138

XLVI. In order to examine the Opinions, of M. *de la Chambre*, S. *Redi*, and others, concerning the Poiſon of Vipers, Dr. *Francini* came to the Houſe of S. *Magalotti* 2 *Jun.* 1672. and ſent for a Box in which were a great many Heads, cut off that Morning, of Vipers lately come from *Naples*, S. *Magalotti* alſo ſent to the Publick Market for a couple of *Pigeons*, to be ſure of having ſome that were not prevented by any *Antidote.* The *Pigeons* being

Experiments made with Vipers; *By* Mr Thomas Platt, n. 87 p. 505.

ing come, the firſt was wounded with the Teeth of a *Viper's* Head that had been cut off about 7 or 8 a Clock the ſame Morning. The way of making the Wound, was by thruſting twice the *Maſter Teeth* into the fleſhy part of the Pigeon's Breaſt, till ſuch time as preſſing the upper part of the Jaw, the two little Bladders, that ſerve as Gums to the Teeth, did empty out upon the Wound ſome of that *Yellow Liquor* which here is ſuppoſed to be the true and only Poiſon of the *Viper*. This *Pigeon* being thus Bit, and ſet upon the Ground, began to ſtagger immediately, and died in leſs than 3 or 4 Minutes. The ſecond *Pigeon* was wounded in the ſame manner; but at the firſt Wound there only entred one of the Teeth, which brought forth a great deal of Blood; the ſecond time they both entered, and this had the ſame fate, with this difference only, that he languiſh'd half a quarter of an Hour.

The next Morning 6 Pigeons and a Cock having been brought, Dr. *Francini* at firſt, thruſt ſeveral *Thornes* of *Roſe Shrubs* into the Breaſt of one of thoſe Pigeons, to manifeſt, that ſuch Accidents as might befal thoſe that ſhould be Wounded by the *Teeth* of the Dead *Vipers*, were not meerly cauſed by the Wound; and afterwards for the further ſatisfaction of the Company, he took a Pin, which was none of the leaſt, and gave another Pigeon a very deep Wound in the Breaſt, which was no ſooner got free, but began to leap and friſk about the Room, as if it had not been concerned in the leaſt. Then a third Pigeon was bit in the Breaſt by both the *Maſter-Teeth* of a *Viper*s Head, that had been cut off the Morning before; the Effect was, that the Pigeon had the ſame ſhaking Fits; after which, falling upon his Belly, in 5 or 6 Minutes after the Wound, he died; giving Signs a little before of a Painful Agony, by his often Gaping. Another having been ſerved after the ſame manner with another Head, had the like Accidents, and Died within a quarter of an Hour. It was alſo obſerved that the Wound of this laſt Pigeon let out a great deal of Blood, whereas not ſo much as one Drop was ſeen to come out of any of the others.

After the Experiments the Doctor took three Stalks out of a Broom, and having ſmooth'd them, and ſharpened them at the ends after the manner of a *Lancet*, he drew from the Gums of ſeveral Heads enough of that Jellow Juice to dawb two of thoſe Stalks; which being thus moiſtened with that Liquor, were both put into the Breaſts of two Pigeons, and there left, the like having been done to another with the third Stalk not covered with that Juice, which was at leaſt one third part bigger, and longer than the other two. In a word, the two firſt died within 4 or 5 Minutes, and the laſt was in *Auguſt* following in S. *Magalotti*'s Pigeon-Houſe, as briſk and fat as ever, tho' the Stalk was not drawn out till after ſome Days.

Upon a Relation, that ſome had aſſerted at *Paris*, that to Swallow a *Viper*'s Head, was a moſt certain Preſervative and Remedy againſt the biting of a *Viper*. Dr. *Francini* made theſe two Experiments, he made the Cock ſwallow a Viper's Head, and then cauſed him to be well bitten in both Thighs by a Live one. The other Experiment was by thruſting the *Teeth* of a Dead *Viper*'s Head into another Pigeon, that had before got down one

of

Fig. 208.

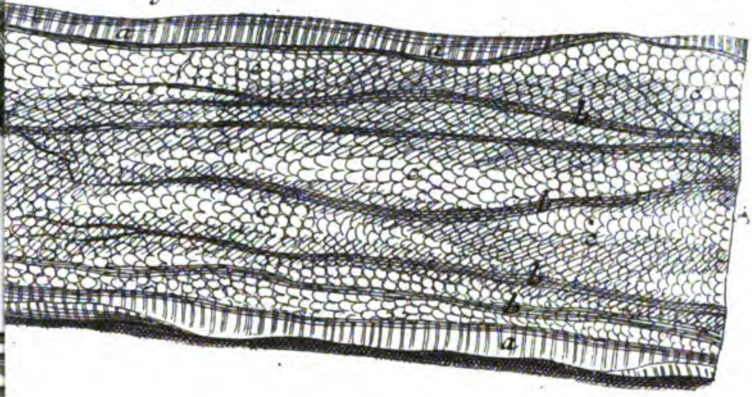
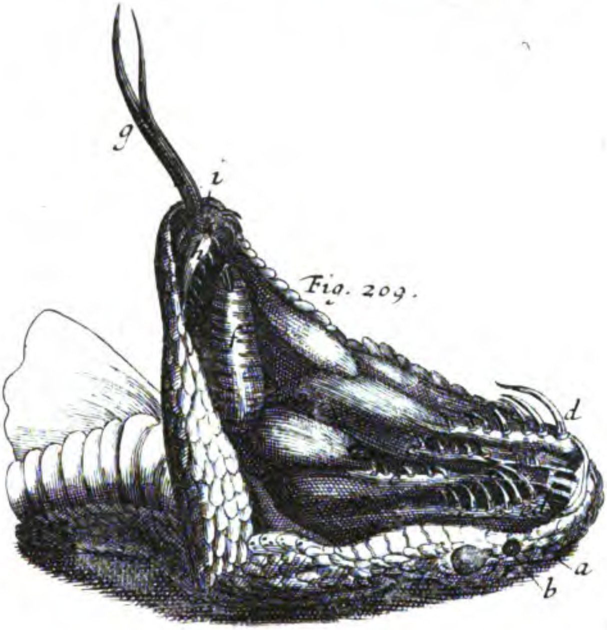


Fig. 198

Fig. 209.



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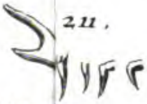
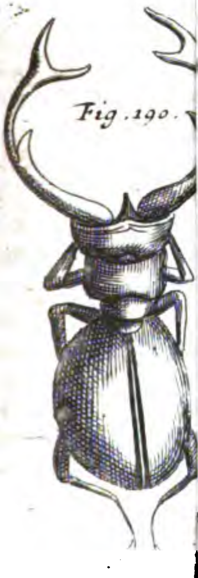


Fig. 190.



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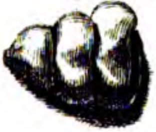
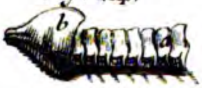


Fig. 214.



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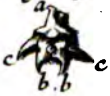

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p. 358

Fig. 204.

Fig. 203.

of theſe Heads into his Belly. The Concluſion was, that both died, the Cock within a quarter of an Hour, and the Pigeon in leſs than 4 Minutes.

Some few Days after, Dr. *Francini* repeated the ſame Experiments, by cauſing two Pigeons to be bit by a *Viper*'s Head that had been Dead above 10 Hours, they both died, one in 6 Minutes, and the other in 8. And with another *Viper*'s Head he Poiſoned a Chicken, which died in 10 Minutes. There appeared afterwards another Pigeon, that had been Wounded, many Hours before, by a Dead *Viper*'s Head, but it had been Dead ſo long, that the Liquor quite dryed up in the Gums was become ſo hard, that for all the ſqueezing of it nothing would come to the *Teeth*, whence this Pigeon was very well: And Dr. *Francini* having cauſed the ſame Bird to be Bit again by the ſame dried Head, it had, after a little fluttering with his Wings, whilſt the Pain of the *biting* laſted, no other harm.

A Live *Viper* then being taken, four Chickens were bit by it one after another. The two firſt, either becauſe the Liquor did not Penetrate into the Wound, or the Blood expelled it, appeared not to have any Diſtemper; the fourth looked as if it would Die preſently, but a little after coming to himſelf, he got clear off for that time; but the third, who ſeemed at firſt to be very lively, Died within an Hour and an half.

There being afterwards a young Bitch brought in, of a pretty ſize, ſhe was bit twice by a live *Viper* in the middle of the hanging part of the Ear. Whereupon ſhe very ſoon began to give Mortal Signs, by Staggering, Vomiting and being Convulſed: after which having a little Recovered her ſelf, the ſame Accidents returned upon her, by which ſhe was reduced to ſuch a grievous Condition, that four Hours after her being *bit*, ſhe could not ſtir any more, and ſeemed juſt as if ſhe had been Dead, holding out her Tongue, and looking very gaſtly, without any other ſign of Life than that of a painful Breathing; to which ſhe added ſometimes a faint Barking, and a Languiſhing Howling. In this Condition ſhe was ſtill found next Morning; only her Reſpiration was yet weaker, and ſhe appear'd juſt a drawing to her end. It was obſerved that no part of her *Body* was ſwelled, nor had ny Spot upon it. She had voided backward ſome Matter of a very black Colour, of which her hind Parts being very foul, a ſwarm of *Gnats* and *Waſps* vere devouring her alive: Which moved one of the Servants of the Houſe, o knock her on the Head.

After this, there were bit two *Capons* and a *Pullet* by a freſh *Viper*, vexed n purpoſe; and becauſe they gave not then any Signs of being Ill, they ere ſent back to their *Coops*, and there having continued well till Evening, hey were ſurprized at Night by a Diſtemper, which in all likelyhood proeeded from the Poiſon; for next Morning one of the *Capons* and *Pullet* were und Dead.

XLVII. Mr. *Rob. Burdet*, an *Engliſh Merchant* at *Aleppo*, on the fourth *Oct.* 578. was *bit* by a *Serpent* on the left Wriſt, near the Pulſe towards his and. It ſeemed at firſt like two Pricks of a Pin; he immediately vomited; d his Wriſt and Hand begun to ſwell preſently, he had ſame few Days fore a Looſeneſs, which perhaps this increaſed. He rode eaſily, after he

The Symptoms attending the Bite of a Serpent, By Mr. Aar. Goodyear. n. 245. p. 35[illegible] was *bit*, about *two* Miles Home, and as ſoon as he got to his Chamber, he ſaid he was bit by a Rat, (and would not own it was a Serpent) though a *Turk* accidentally paſſing by, ſaid he ſaw the Serpent hang at his Wriſt, as he pull'd his Hand out of the Refuge, hoping to have taken a *Hare* that he had Cours'd in there. He ſaid he felt no Pain, but a great deſire to *Sleep*; his Arm continued Swelling upwards, and grew Black. Some little Remedies were uſed till the reſt of the *Factory* return'd, and then they begun to Cup and Scarify his Arm; he having ſtill no Pain, but a great Drowſineſs; but was kept Waking, to uſe that little time he had left, to prepare himſelf for Death; which he performed exceedingly well. At laſt the Swelling came up to his Shoulder, and then he Complained much; and within a Quarter of an Hour died. He was *bit* about 10 in the Forenoon, and died about three in the Afternoon. His Body Swell'd much after Death, and Purged. The *Snake* was like a Common *Snake* for length, his Colour dark Sandy, with black Spots, his *two Teeth* or *Fangs*, are like thoſe of a *Rattle Snake* on the upper *Jaw*, the Poiſon lies in the *Gums*, and wherever they fetch *Blood* of any Creature they certainly kill, though in ſome parts ſooner than in others. The People of the Country ſay, that if as ſoon as one is *bit* by a *Serpent*, they ſhall Suck immediately the Wound, they may be ſaved: but they muſt rub firſt their *Gums* and *Teeth* with *Oil*, that none of the Poiſon may touch any place where the Skin is broken, and Spit out immediately what they Suck; every time waſhing the Mouth, and taking more *Oil*. This *Serpent* kill'd a Dog, in about eight Minutes time, biting him at the end of his Ear; and *two* Young *Turkeys* afterwards in *three* or *four* Minutes each, *biting* them at the end of a Claw; and then we Poyſoned him with the *Oil* of *Tobacco* out of a *Reed Pipe* (that had been much uſed, and not Cleanſed for a *Weak* or *two*) and he died in about *two* or *three Minutes*, trembling as ſoon as the *Oil* was dropt into his Mouth.

A Stone Healing the Biting of a Serpent; By Sir Phi. Vernatti. n. 6. p. 102:

XLVIII. Sir *Philiberto Vernatti* ſome time ago ſent from *Java Major* (where he reſided) a certain *Stone* affirmed by him to be found in the Head of a *Snake*, which laid upon any *Wound* made by any *Venemous* Creature is ſaid to Stick to it, and to draw away all Poiſon: and then, being put in Milk, to void it's Poiſon therein, to make the Milk turn Blue; in which manner it muſt be uſed, till the Wound be Cleanſed. The like Account of ſuch a *Stone* is given by M. *Thevenot* in the Relations of his *Voyages* and *Travails*.

Obſervations *on ſeveral* Poyſons; *By Sir* Theodore de Mayerne, n. 211. p. 15.

XLIX. The *Venome* of a *Viper* in it ſelf is not Mortal to a Robuſt and ſound Body: and tho' very unhappy and miſchievous Accidents attend it, as a great *Tumour*, *Tenſion* and *Weight* of the Part, *Humidity* and *Variety* of *Colour*, *Phrenſies*, *Convulſions* and *Vomitings*; yet in 8 or 10 Days at moſt theſe Accidents are over: and although the Patient may be very Ill, yet he recovers again; whilſt the Poiſon, having run through divers Parts of the Body, at laſt always *throws* it ſelf into the *Scrotum*, or *Swelling* it extreamly cauſes a great heat and quantity of *Urine*, very hot and ſharp, by which it is diſcharged; this *Evacuation* being the Ordinary and moſt certain *Criſis* of the *Diſeaſe*.

It is Obſervable that the Perſpiration being Obſtructed by the Poiſon, a Man *bit* by a *Viper*, and *ſwelled* up, in three or four Days ſhall Weigh almoſt as much more than he did before. A Sickly Perſon, under an ill habit of Body, or fearful, dies infallibly, and in ſhort time by this *Venom* without ſpeedy help. In the Extream *Nervous Parts*, near the Pulſe and Tongue, the *bites* are dangerous, and Accidents very painful. Freſh *Vipers* that have not *bit*, but have the *Bladders* of the *Gums* full of *Venom*, are the moſt Miſchievous. Wherefore *Mountebanks* to impoſe upon the People, either make their *Vipers bite* before they bring them out; or with a Needle ſcratch the *Gums*, and preſs out the Poiſon.

The Remedy for theſe great and painful *Swellings* is, to Drink the *Decoction* of *Marrubium*, or the Powder taken inwardly, and a *Fomentation* with the *Decoction*, applying a *Cataplaſm*, made with *Marrubium*, *Tapſus Barbatus* and *Agrimony* on the place. *Ariſtolochia* is alſo a ſtrong and powerful *Antidote* againſt the *Viper*; ſo that if one be *bit* on the Tongue, he need only take a ſlice of this Root, heat it and apply it, and it goes away.

Pontæus, a Chymical *Mountebank* (from whom I had the above mentioned Obſervations) compoſed his *Antidote* of *Extract* of *Juniper Berries* drawn with a *Decoction* of *Roots* of Round *Ariſtolochia*, of *Succiſa*, *Marrubium Album*, *Flower of Brimſtone* and of *White Vitriol*. For *Poiſon* not *Corroſive*, ſuch as thoſe of *Animals* and *Vegetables*, and even for the *Plague* it ſelf, (which he believes he can Cure by the ſame Remedy) he makes uſe of no *Vitriol*: But if the Poiſon be *Sublimate*, which of it ſelf excites Vomiting, he adds *Vitriol*; not in a proportion to Vomit, as a *Drachm*, but only a *Scruple* or half a *Drachm*, the Vomiting being aſſiſted by the Corroſive Poiſon it ſelf.

To Encreaſe the Value of this *Antidote* with the People, when the Experiment is made on Dogs, to that Dog which they would have dye of the *bite* of the *Viper*, he gives with the *Antidote* a Quarter of a *Nux Vomica* not powdered but only cut in Bits, and the next Day the Dog dies. If it were powered the Dog would die in half an Hour. He ſays *Nux Vomica* never Vomits but ſhuts up the Stomach, and Contracts the *Nerves* by its Poiſon. To preſerve the Dogs alive, you muſt give them with the *Antidote* or any thing elſe, three or four Grains of *Sublimate*, which immediately ſets them a Vomiting, and ſo ſaves them alive.

He offers to take all ſorts of Poiſons, even *Corroſives*, after an ordinary *Meal*, and for a Tryal of Skill he refuſes them not on an Empty Stomach. He much eſteems *Morſus Diaboli*, *Succiſa* or *Devil's Bit*, againſt all ſorts of Poiſons. He laughs at the Poiſon of a *Toad*, which he ſays has none at all, no more than a *Frog*.

The manner of the Acting of the *Vipers* Poiſon is thus; In about ¾ of an Hour, a *Syncope*, or *Swooning*, ſeizes them with *Trembling*; and *Convulſions*, *Tingling* of the *Ears*, and frequently *Deafneſs* for a Moment, next as it were White Sail comes before their Eyes, which ſoon Vaniſhes: On the place f the *bite* a *Swelling* Riſes, at firſt of the bigneſs of a *Pea* which grows as big as a *Bean* or a *Nut*, and Increaſing inlarges it ſelf over the Neigbouring parts, to a very conſiderable *Tumour* and ſtretching of the Fleſh, which grows *œdematous*, and by little and little falls into the *Scrotum*, and leaves the Part *Black*, *Blue*, and *Yellow*. It makes as it were Bags in the Skin, which feel heavy when you Walk, as if fill'd with *Quick-ſilver*. Do what you will the Poiſon will have its Courſe; and it is uſually three Days before it comes to the heighth, and as long abating.

He ſays the *Gall* of the *Viper* is no ways *Venomous*: all the Poiſon is in a Liquor in the *Gums*, which is Yellow like *Oil*; of which you may eaſily Diſarm the *Viper*. The *Viper* is moſt *Venomous* of *Serpents*; the *Aſp* is but a *Species* of the *Viper*. The *Napellus* is a very dangerous Poiſon, acting by its *Acrimony*: but you muſt take a great quantity of it. It burns the Throat extreamly as does *Alum*; but it is cured by the *Antidote*. *Crude-Antimony* does nothing if attaqued by the *Antidote*.

The moſt miſchievous of all Poiſons is *Opium*; of which having given an Exceſſive Quantity to a Servant, at firſt he had *Convulſions*; then ſtrange Vomitings, not able to let any thing go down into his Stomach; a Sleepineſs following; all which time they kept him *Awake* as much as poſſible. At laſt all of a ſudden, he grew Well, and called for Victuals.

A Salamander; By S. Steno. n. 21. p. 377

L. M. *Steno* Writes from *Rome*, that a Knight called *Corvini* had aſſured him, that having caſt a *Salamander*, brought him out of the *Indies*, into the Fire, the Animal thereupon *ſwell'd* preſently, and then Vomited ſtore of thick Slimy Matter, which did put out the neighbouring *Coals*, to which the *Salamander* retired immediately, *Putting them out* again in the ſame manner, as ſoon as they *Rekindled*; and by this means ſaving himſelf from the force of the Fire for the ſpace of 2 Hours; That afterwards it lived 9 Months, that he had kept it 11 Months, without any other Food, but what it took by *Licking* the *Earth*, on which it moved, and on which it had been brought out of the *Indies*, which at firſt was covered with a thick Moiſture, but being dryed afterwards, the *Urine* of the *Animal* ſerved to Moiſten the ſame; but being put upon *Italian Earth* it died 3 Days after.

Obſervations on a Cameleon; By Dr. Jonath Goddard. n. 137. p. 930.

LI. This *Cameleon* was a *Female*; The Skin appeared mixt of ſeveral Colours like a Medley Cloth: Lighter towards the Belly, otherwiſe near upon it, equally mixed. The Colours diſcernable are Green, a Sandy-Yellow, a deeper Yellow towards a Liver Colour: and indeed one may eaſily fanſie ſome Mixture of all or moſt Colours in the Skin; whereof ſome are more Predominant at ſometimes. There are ſome Permanent Black Spots on the Ridge of the Back, and on the Head Upon Excitation, or Warming, ſhe becomes ſuddenly full of Black Spots of the bigneſs of a great Pins Head equally diſperſed on the ſides, with ſmall black Streaks on the *Eye-Lids*; all which afterward do vaniſh. The Skin is grained with Globular Inequalities, like the Leather called *Shagreen*. The groſſeſt Grain is about the Head, next on the Ridge of the Back, next on the Legs; on the Sides and Belly fineſt: Which perhaps in ſeveral Poſtures, may ſhew ſeveral Colours, and when the

Creature is in full Vigour, may alſo have in ſome ſort *Rationem Speculi*, and *Reflect* the Colours of Bodies adjacent: Which, together with the Mixture of Colours in the Skin, may have given Occaſion to the old Tradition of Changing into All Colours.

The Eyes reſemble a *Lens*, or *Convex-Glaſs*, ſet in a Verſatile Globular *Socket*; which ſhe turned *backward*, or any way, without moving her Head. And ordinarily the one a contrary or quite different way from the other. The Tongue, (which ſhe was never ſeen to put forth of late, though ſhe often opened her Mouth Wide) was eaſily drawn out, when ſhe was Dead, to half the length of her Body, being round and full towards the end, like a *Peſtil*, with ſome Cavity at the Extremity: Having a *Bone*, about half the length of it, toward the Root; over which alſo the Fore part would ſlip *backward*. The *Bone*, where connected to the Body, is Bifurcated. She hath *Teeth* plainly to be felt and ſeen above and below, on the whole Circumference of the *Jaw*.

The Trunk of the Body, for the Structure of it, is all *Thorax*, or *Breaſt*, having *Ribs* from the *Neck* to the ſetting on of the *Tail*. The *Ribs* are of *two* ſorts; the larger above tending *backward* from the *Spine*, or *Back Bone*; the other, from the Extremities of the former, tending *forward*, as in the *Breaſts* of *Fowls*. There is a kind of *Diaphragm*, a thin Tranſparent *Membrane*, as in *Birds*, ſeparating a ſmall Portion, about the fourth part of the *Cavity* next the *Belly*, from the reſt: Wherein is contained a ſmall *Ventricle* connexed to the *Gula*; to which is continued an *Inteſtine*, having ſome little *Convolution* in the Conveyance of it; which extended might be about the length of the whole Body, with Head and Tail. The *Excrements* therein *Black* or of a *Sad French Green*. She had a ſmall thin Liver Contiguous to the upper part of the *Diaphragm*: In part divided into 2 *Lobes*, of a *Blackiſh*, or very *Sad-Colour*. The *Lungs* ſeemed to be made of *Membraneous Cells*, or *Diviſions*, very thin and Tranſparent, reſembling a little light *Froth*. The *Heart* was firm and fleſhy, but very ſmall; and at the very fore End of all the *Breaſt*, or Body. At the hinder End of the Body was a double *Ovary*, conſiſting of 5 or 6 Eggs (of the bigneſs of the greateſt Pins Heads, and ſticking to the Back) on each ſide; of the ſame Colour and Conſiſtence with thoſe of the Yolk of an Egg.

LII. Miratus ſum valde, D. *Thruſtono* in *Teſtudinum*, *Lacertarum* & *Ranarum* Sectionibus non occurriſſe Commercium inter *Bronchia* & *Pulmones*, quos *Veſiculas*, a laxitate Exterioris *Pulmonum Membranæ* obortas, vocat; cum ſane immiſſa in *Tracheam* Fiſtula, & ſimul inſufflato Aere, *Pulmones* eidem *Tracheæ* appenſi hinc inde circa *Cor* turgeant; quod & ad Libitum Animalis frequenter accidit: Hi etiam, dum Aere turgent, ſi filo innoden-ur ut Sicceſcant, ſecti patenter oculis *Cellulas* & *Veſiculas*, evidenter *Mem-raneas*, exhibent. Et licet in *Ranis* brevis ſit *Bronchiorum* proceſſus, a *Larynge* amen Bini Ductus, Semicircularibus aliquot Annulis conflati, in *Membraneas Veſiculas* hiant; atque ita ſuccedit *Inſpiratio* & *Expiratio*. At in *Teſtudine*,

Obſervations about the Lungs of Frogs; By S. Malpighi. n. 71. p. 2149.

Diatriba de Reſpir. Uſu. Primario.

Lacertis & ſimilibus, oblonga *Trachea* in binos ſubdiviſa Ramos, Aerem *Pulmonaribus Veſiculis* ſubminiſtrat. Scio in *Ranis*, prope *Os*, hinc inde binas interdum turgentes erumpere *Veſiculas*, (procul tamen a *Pulmonibus*) quæ *Buccæ* ſunt Appendices, & Aere interdum, a *Pulmonibus* in *Oris* Cavitatem *Expiratione* propulſo, foras exilire.

Circa exaratos *Pulmones* Reticularem *Muſculum* locari ſcias, cujus *Carneos* Plexus, Sinus, & *Veſiculas* ambientes, alias ruditer delineavi. Hujus Mirabilis Contextus patet in *Ranis*, & *Lacertis* præcipue; nam Multiplices *Carnei* Lacerti per Longum producuntur, & Tranſverſaliter elongatis Fibris invicem continuantur: intermediæ vero areæ Reticularibus *Carneis* Plexibus ulterius occupantur, non abſimili ritu ac in *Arborum* Foliis accidit: *Retis* autem enarrata hæc Minora Spatia rectis poſtremo Fibris, quaſi brevibus Tendinibus, pervaduntur. Mirabilis hic *Muſculus* non Exteriorem tantum *Pulmonum* ambit Regionem, ſed interiores quaſcunque *Veſiculas* & Sinus circundat, ita ut ſuo Motu ſingulas *Pulmonis* partes comprimendo, *Expirationem Sonumque*, promoveat. Hæc eadem Structura in *Pulmonibus* Perfectorum Animalium proportionaliter obſervatur, & in *Agnorum* extremis præcipue *Lobulis*, Aere turgidis, & adhuc Mollibus, patet.

The Production of Todpales; By Mr. Rich. Waller. n. 197. p. 523.

LIII. *Mar.* 12. 1689. I took ſome *Frog-Spawn* out of a Ditch, which I ſuppoſe might have been Spawned about 14 Days, and kept it in a Gally-Pot of Water; which I ſhifted every Day or two, and kept them in a Window where the Sun Shined ſome part of the Day. At the firſt they
Fig. 217. appear'd as *Fig.* 217. being a round black Globule Encompaſt with a Clear Liquor as I afterwards found, and a *Membrane* encompaſſing that Liquor, and
Fig. 218. that encompaſſed with a larger Sphere of a more Mucous Liquor. The ſecond Day they appear'd as *Fig.* 218. The third Day as *Fig.* 218. The fourth
Fig. 219. Day as *Fig.* 219. About the ſixth Day, ſeveral of them were looſed from their Eggs, and on the ſeventh and eighth more of them: When they appear'd of
Fig. 220. the ſhape of *Fig.* 220. which in *Fig.* 221. is repreſented bigger than the Life,
Fig. 221. that the Poſture they lay in may be ſeen the better. On the ſeventh and eighth Days, upon pricking of them with the point of a Needle they would Contract themſelves; ſome of them on the eighth Day would of themſelves bend their Bodies, but not move out of their Place. When they firſt got through their *Egg* (which I ſuppoſe they did by Eating their Way) they hung faſt upon the outſide of it, by that Part which I afterwards found to be their Mouth and when looſed from their hold they ſunk to the bottom of the Water, and could not riſe again. On the *9th* Day they were not viſibly increaſed in bulk, only they moved themſelves more freely at the bottom of the Veſſel.

At about 14 Days End they appeared as *Fig* 222. at which time they *Swam*
Fig. 222. about in the Water by moving their *Tails*, as *Fig.* 223. and ſome Rudiments
Fig. 223. of their *Fore-Legs* were viſible, which looked Forked and like the Sprig of a *Plant*. At three Weeks end their Mouths were to be ſeen, which they Opened and Shut, and emitted *Fæces* from the other End. At a Months end the *Eyes* were to be diſcerned, at which time they would *Swim* near the

Top of the Water, and opening their Mouths let out a ſmall Bubble of *Air*, and I ſuppoſe take in freſh.

The Liquor which was contained in the innermoſt *Membrane*, was more tranſparent than the other, which was a *mucous Liquor*, and like the White of an *Egg*, the whole was a little heavier in ſpecie than *Water*, for a ſingle *Egg* ſunk when looſed from the reſt; but when they were faſtened a great many together, they *ſwam*, every 3 *Eggs* leaving a little ſpace, which being fill'd with Air, made them ſpecifically lighter than common Water.

The *Stomach* of a Leech, by Dr. Edw. Tyſon, n. 144. p. 33.

LIV. The *Ductus Alimentalis* in *Animals*, from its uſes, may ordinarily be divided into 4 Parts. 1. That which conveys the Food, as the *Oeſophagus*. 2. That which digeſts or corrodes it, the *Stomach* 3. That which diſtributes the *Chyle*, the *Inteſtine*. 4. That which empties the *Fæces*, the *Rectum* But a *Leech* is all *Stomach*, from one End to the other, and does devour at a *Meal* ſeveral times the Weight of its whole Body. The *Stomach* when ſwelled and ſtretcht with Blood is far bigger than the *Leech* it ſelf, nay ſeveral times exceeds it. But I miſtook the Number, it was not one, but many Stomachs, for the Cavity is divided by ſeveral *tranſverſe Membranes*, in divers diſtinct *Camera's*, but theſe *Membranes* in the Middle have a Hole that leads from one into the other; but by the pouching out of each ſide, each of theſe may be reckon'd alſo two; in all we may number, (there being 10 or 12 of theſe *Camera's*, beſides theſe 2 long Ones, which at laſt run to the Tail) at leaſt 22 if not 24 Stomachs. But the *Rectum*, which lies between the Forking of the 2 laſt long *Sacculi*, or *Stomachs*, is but ſmall and ſhort in Reſpect of the whole.

The *Anatomy* of a *Leech*, by M. Fr. Poupart, n. 233 p. 722

LV. The *Upper Lip* of a *Leech* is ſtretched out into a Point, and falls upon the *Under*, which is round like a *Creſcent*, and ſhorter. Its Throat on the inſide, is covered with a great many *white Muſcles*, about 5 or 6 Lines long, as big as a ſmall thread, and lying parallel one to another, along its Body. When it applies the Mouth to the Fleſh of any *Animal*, all theſe *Muſcles* contracting themſelves, ſhe ſucks it with ſo great Violence and Greedineſs, that ſhe makes it enter in Form of a little *Pap* into its Throat. So that all the Effect of Suction terminating in a very little ſpace, of Neceſſity the Fleſh muſt break in that Place.

There is ſeen at the End of its *Tail*, a little flat thing exactly round, the Border of which is elevated far above the *Tail*, and all round it, which it applies ſo uniformly upon the Bodies to which it faſtens it ſelf, that it touches them in all their Parts, and then drawing up a little the middle of this flat part, without taking off the Edges, ſhe makes of it, as it were a little *Balm*, which leaves a *Cavity* in its Middle. This excellent *Glue* faſtens ſo ſtrongly to the *Tail* of the *Leech*, that 'tis a hard Matter to pull it away without making ſome Rent eſpecially if you draw it perpendicularly from the Surface on which the *Animal* is faſtened. It has always Recourſe to this little Inſtrument, for faſtening its Body, to the End it may not be ſuſpended in the

Air, while it draws its Nouriſhment by Suction, or elſe that it be not carried away with the Current of the Water, while it carries its Head here and there for ſeeking its Nouriſhment.

Its Gut goes in a ſtraight Line from the Mouth to the *Anus*, as big as a *Gooſes Quill*, all along ſet with a great Number of little *Valves*: Some of which make a perfect Circle, with a Hole in the middle, and others a half-moon; ſome are ſhap'd *Spiral-ways*, and there is a great one of this ſort near the *Tail*, faſhioned like a *Heart*, which leaves only a very little Hole, near which is found much *yellow Fat*, which fills all the Cavity of the *Inteſtine* to half an *Inch*. Two little *Inteſtines* or *Appendixes*, each half an Inch long and of the Bigneſs of the Feather of a little Bird's Wing pierce the great Gut, in which they are open at one End, and ſhut at the other. All this Structure makes it evident, why the *Inteſtine*, which makes no Convolutions, and yet reſerves ordinarily but liquid Aliments, does yet retain them to a perfect Concoction.

A *Nerve* the Bigneſs of a *Horſe-Hair*, all black, hard to break, having *Knots* at a Diſtance one from the other, beginning at the *Mouth* of the Animal, paſſes over the Parts that ſerve for *Generation* in the *Male*; 'tis faſtened in a ſtraight Line all along the Gut above, ends at the little Circle in the End of the *Tail*, and in the Way ſends out Branches to the right and left Side, which go from every Knot. 'Tis very probable that by this Canal, the Animal Spirits run abundantly, which gives ſo great Briskneſs to this *Reptile*, which makes it ply into ſo many Faſhions, ſwim ſo ſwiftly, ſo properly, and ſuck with ſuch Greedineſs.

The *Leech* is *Hermaphrodite*, the Parts of the *Male* deſtinated to Generation, are placed where the *Neck* ought to be. The *Yard*, which is about 2 *Inches* long, is white, round, hollow and griſtly: A Part of the Yard, which is always in the Body, is a Sheath, about 15 Lines of an *Inch* long, as big as a little Bird's Quill, covered with a fine *Membrane*, which faſtens it ſtrongly to the *Belly*, round about a little Hole given the *Leech* for putting out and in his *Yard* when he pleaſes, and not for *Breathing* as the Ancients ſaid. The other *Part* of the *Yard* which comes out 9 or 10 Lines of an *Inch*, is the Bigneſs of a ſowing *Thread*, and the End of it, for the Length of two Lines, is bigger than the reſt. All the *Yard* is hollow, and has in his Cavity a White *Muſcle* as big as a Hair, faſtened only to the Root and Head, all the reſt being at *Liberty*. 'Tis with this *Muſcle* that the Animal draws the *Yard* into its *Sheath*, which any one may try by *Cutting* it at the *Root*, to draw out this *Muſcle* with his Nails. On every ſide of the *Root* of the *Yard*, is a little *white Web*, flat, oval, about 2 or 3 Lines long, reſembling ſmall Guts, twiſted about with a *Cartilaginous Body*, as big as a double Thread, and 2 *Lines* long, which faſtens to the *Root* of the *Yard*, in which 'tis probable it carries the *Prolifick Matter*. A little above the *Root* of the *Yard* between theſe 2 Webbs, there is a *little Griſtly Globule*, 2 Inches long, White, Hard, Hollow, Round, Oval, Sharp, *inwardly* covered with a *Membrane*, Wrinkled and full of a milky Liquor. There is at the Head of this *Globule* a ſmall Web, like to an *Epididymis*, whoſe little *Canal*, of the ſame Piece with it, creeps over the *Globule*, and is faſtned at the Point of it, and above the *Epididymis* are 2 *Glands* exactly round, each as big as a Grain of *Millet*. I take this little *Globule* to be a *Teſticle*. All along every ſide of the *Inteſtine* is a white Canal, or *Ovarium*, of the bigneſs of a ſmall twiſted Thread, and folded in a thouſand Manners, to which are faſtened with a *Tail*, as it were the Grain of a Raiſin to their *Grape*, many little *Globules* exactly round, as big as a little Pea, full of a milky Juice, and ſome little white Eggs, griſtly, perfectly round, as big as a Grain of *Millet*, hard, which are hardly broken, making a Noiſe, and full of a white Matter. There is in the *Inteſtine*, towards the End, a great *Valve* faſhioned like a Heart, with 2 little Bags, where begin 1000 ſmall Channels made of fine yellow fat which fill the Cavity of the *Inteſtine* for half an Inch. It's probable, that theſe Paſſages of Fat receive the Prolifick Liquor to conduct it into the *Ovarium*.

An extraordinary *Leech* which torments the Sword-fiſh, by *S. Paulo* Boccone, n. 99. p 6159.

LVI. There is an extraordinary *Sanguiſuga* or *Leech*, found ſometimes ſticking faſt in the Fiſh call'd *Xiphias*, or *Sword-Fiſh*. *S. Boccone* gives it the Name of *Hirudo*, or *Acus Cauda utrinque pennata*, becauſe of its working it ſelf into the Fleſh, and ſucking the Blood of the ſaid Fiſh. He deſcribes it to be of about 4 Inches long, the Belly of it white, cartilaginous and tranſparent, without Eyes or Head, (that he could obſerve,) but inſtead of a Head, it had a hollow Snout, encompaſſed with a very hard *Membrane*, differing in Colour and Subſtance from the Belly; which Snout it thruſts whole into the Body of the Fiſh, as ſtrongly as an *Augre* is wound into a piece of *Wood*, and fills it full of Blood unto the very Orifice. It hath a Tail ſhaped like a *Feather*, ſerving for its Motion, and under it two Filaments, or ſlender Fibres, longer than the whole Inſect, whereby it ſeems, it clings about Stones or Herbs, and ſticks the cloſer in the Body of the *Sword Fiſh*, of which it attacks thoſe Parts only where the Fins of the Fiſh cannot touch or trouble it, the Obſerver affirming, that he hath often found it ſticking in the Back, and in the *Belly* and ſometimes cloſe to the Head, ſometimes cloſe to the Tail of that Fiſh, but always far enough from the Fins. Within its Belly he noted ſome Veſſels like ſmall Guts, reaching from one end of it to the other, which by the Preſſure of his Nail, he made reach to the Orifice of the *Snout*, whence they retired back of themſelves to their natural Situation; they ſeeming to be the Inſtruments for ſucking the Blood, becauſe the *Snout* is in it ſelf an empty Part, deſtitute of Fibres and Valves, to draw and ſuck with; whereas theſe Veſſels having a Motion reſembling that of a Pump, in which the Snout of this Animal ſerves for a Sucker, drawing the Blood from one End to the other: And the Belly of this Inſect being fram'd Ringwiſe, the Structure ſerves to thruſt the ſaid inner Veſſels unto the Orifice of the Trunk, and to draw them back again.

This Creature as it torments the *Sword-fiſh*, ſo it is, by our Obſerver's Relation, vexed it ſelf by another Inſect, which he calls a *Louſe*, of an *Aſh*-Colour, faſtened toward the Tail of this Leech as firmly as a Sea-ſnail is to a Rock. 'Tis of the Bigneſs of a *Pea*, and hath an Opening, whence come out many ſmall winding and hairy Threads. It hath not been obſerved,(as far as our Author could learn) to trouble, or to be upon any other Animal than this *Leech*.

The odd Turn of ſome Shell ſnails. by Dr M. Liſter. n. 50 p. 1011. n. 72. p. 2171.

LVII. I have found 2 Sorts of *Shell Snails* eaſily diſtinguiſht one from another, and from all beſides, becauſe the Turn of the *Wreaths* is from the Right Hand to the Left, contrary to what may be ſeen in *common Snails*. They are very ſmall, and therefore might well eſcape thus long, the more curious Naturaliſts; neither of them much exceeding, at leaſt in Thickneſs a large *Oat Corn*.

The firſt I thus deſcribe: The Open of the *Shell* is pretty round; the Second *Turn* or *Wreath*, is very large for the Proportion, and the reſt of the *Wreaths*, about the Number of ſix are ſtill leſſened to a Point. This *Turben*, or *Conical Figure*, is well near a Quarter of an Inch; the Colour of the Shell is duskiſh, yet when the ſhrunk Animal gives Leave, you may ſee Day through it, and then it is of a yellowiſh Colour. Theſe *Shells* are extream brittle and tender.

The ſecond ſort ſeem to be much ſtronger and thicker ſhell'd, they are well near half as long again as the other, and as ſlender, they have the exact Figure of *Oat Corn*, being, as it were, pointed at both Ends, and the Middle a little ſwelled. The Open of the Shell is not exactly round, there being a peculiar Sinus in the lower Part thereof. I think you may number about 10 Spires, having their Turn from the Right Hand to the Left. The Colour of the Shell is of a dark and reddiſh brown.

Both theſe ſorts of Snails when they creep, lift up the Point of their Shells towards a Perpendicular, and exert, with part of their Body 2 Pair of Horns, as moſt of their Kind do.

Cat. Plant.

In *March* I have ſeen many of them pair'd, and in the very Act of Venery, and therefore it is moſt certain, (contrary to the Opinion of *Ariſtotle*) that they engender. But whether thoſe that are thus found coupled, be one of them *Male* and the other *Female*, or rather, as Mr. *Wray* hath obſerved, that they are both Male and Female, and do, in the Act of Generation, both receive into themſelves, and immit a like *Penis*, (as it ſeems probable to any Man that ſhall part them) I ſhall not determine.

Theſe Snails are to be found, frequent enough under the looſe Bark of Trees, as old *Willows*, and in the ragged Clefts of *Elms* and *Oak*, *&c.* and in no other Place that I could obſerve.

Some ſort of Virginian Snails, by Mr. J Baniſter, n: 198: p. 671.

LVIII. 1 The Outſide of one ſort of *Land-ſnails* in *Virginia*, is of *Aſh Colour*, inclining to a yellow, the Inſide White, with a Bluſh of Red, and in the Middle of the Entry, on the Inturn of the Shell, grows a ſmall white Tooth or Protuberance. But what is moſt remarkable, the Shell it ſelf is tranſparent, and you may plainly perceive by the Opacity there, that the Body of the *Animal* lies near the *ſpiral String*, or *Center*, on which the *Arch* is turned, and that the empty Part of the Shell is ſpread with a thin ſpotted Film. Near the Tooth, but more inward, is to be ſeen a little *wateriſh Speck*, which by a kind of *Syſtole* and *Diaſtole*, contracts and dilates it ſelf; from this proceeds a limpid *Trunk*, which runs into the *Film*, and there divides into *Branches*: theſe grow leſſer, and ſpread, as the *Animal* recedes or approaches the Mouth; and when it is out, extend themſelves to the very Lip of the Shell. I ſuppoſe the ſame to be in all, at leaſt the Land Kind, tho' not eaſily to be diſcerned. It is likely alſo, that the *Film*, the *Nautilus*, or *Caroil*, (as the Sailors call it) Exerts, may be analogous to this.

2. This Deſcription of the Heart of a *Snail*, agrees well with the Anatomy thereof, made and long ſince publiſhed by *Harder*, and *Fr. Redi*. By Dr. *Liſter*. ib.

3. There is a ſmall Snail of the Land Kind, with a dented Aperture, and an outward Coat, on which it is *Hirſute*, or rather finely Echinated. I am apt to believe, that theſe (nor hardly any elſe) are not dented, till they are at their full Growth, for I find ſeveral ſmall ones amongſt them, with an open Entrance, that ſeem to belong to this Kind. By Mr. Banſter, ib. p. 672.

I have hitherto obſerved very little Variety of naked Snails, I know of but one Kind, which is a ſmall *Aſh Coloured*, and *ſpotted* one, and *milky*, like Dr. *Liſter*'s Fig. 16.

LIX. In *Oct.* 1684. There were two Ladies at *Minehead*, where I then was, who told me, that there was a certain Perſon living by the Sea ſide in *Ireland* who made conſiderable Gain, by Marking with a delicate durable *Crimſon Colour*, fine Linen of *Ladies Gent. &c.* ſent from many Parts of that Iſland, with their Names, or otherwiſe, as they pleaſed, which was made with ſome liquid Subſtance taken out of a *Shell fiſh*, and one of them thought it to be taken out of the Shells here figur'd and deſcrib'd. Hereupon I made many Experiments on all the Shell Fiſhes I had taken on that Coaſt; and at laſt obtained that delicate Colour they told me of. The whole Proceſs is as followeth. The Purple-Fiſh by Mr. Will Cole. n. 178. p. 1278. Fig. 223, 224, 225, 226, 227, 228.

The Shells being harder than moſt of other Kinds, are to be broken with a ſmart ſtroke with a *Hammer*, on a Plate of Iron, or firm piece of Timber, (with their *Mouths* downwards) ſo as not to cruſh the Body of the *Fiſh* within; The broken Pieces being pickt off, there will appear a White Vein, lying tranſverſly in a little Furrow or Cleft, next to the Head of the Fiſh, which muſt be digged out with the ſtiff Point of a Horſe-Hair Pencil, being made ſhort and tapering. The *Letters*, *Figures*, or what elſe ſhall be made on the Linnen (and perhaps Silk too) will preſently appear of a pleaſant *light green Colour*, and if placed in the Sun, will change into the following *Colours*, *i. e.* if in *Winter*, about *Noon*, if in the *Summer*, an *Hour* or *two* after Sun-riſing, and ſo much before Setting, for in the Heat of the Day, in Summer, the Colours will come on ſo faſt, that the Succeſſion of each Colour, will ſcarce be diſtinguiſht, next to the firſt light green, it will appear of a deep green, and in few *Minutes* change into a full *ſea-green*, after which, in a few Minutes more, it will alter into a *Watchet Blue*; from that, in a little time more, it will be of a Purpliſh Red, after which, lying an Hour or two, (ſuppoſing the Sun ſtill ſhining) it will be of a very deep purple red, beyond which the Sun can do no more. But then the laſt and moſt beautiful Colour, after waſhing in ſcalding Water and Sope, will, the Matter being again put out into the Sun, or Wind to dry, be a fair bright *Crimſon*, or near to the Prince's Colour, which afterwards, notwithſtanding there is no uſe of any *Stiptick* to bind the Colour, will continue the ſame, if well ordered; as I have found in *Handkerchiefs*, that have been waſht more than 40 times; only it will be ſomewhat allay'd, from what it was, after the firſt Waſhing. While the Cloth ſo writ upon lies in the Sun, it will yield a very ſtrong fœtid Smell, as if *Garlick* and *Aſſa Fœtida* were mixed together.

The Shells are of divers Colours, but moſt part of them white, ſome are red, ſome yellow; others of both theſe Colours; ſome a blackiſh brown; many of a ſandy Colour, and ſome few ſtriped with white and brown, paralel Lines. It ſeems to be a kind of *amphibious Animal*, alternately living in both Elements every Tide: For being out of their native Place, and in Want of ſuch Viciſſitudes, they take this Courſe to find the Air, when any of them are put into a Veſſel of Sea-water, (for in freſh they ſoon expire) after they have lain ſometime on the bottom of the Veſſel, they creeping to the Superficies of the Water, and by extending a kind of Lip, with their *Operculums*, cling to the Side of the Veſſel or Pan, (which is moſt convenient for their Aſcent) with about half that Part above the Water; ſometimes creeping down under it, and returning again to their Station, between Wind and Water. Fig. 229.

I have found, that ſometimes their Veins are fuller and whiter, and the Juice more viſcid, at other times more flaccid and watery.

Theſe Shells are in great abundance on the Sea-coaſt of *Somerſetſhire*: I have found them alſo on the Shores of *South-Wales*, oppoſite to it; and I doubt not but they may be found on the other Coaſts of *England*, eſpecially the *South* and *Weſtern* Parts, where I am almoſt aſſured I have formerly ſeen them, tho' then unknown to me. And I am of Opinion, there may be found on our Marine Coaſts, ſome bigger Shells which may have a colouring Juice, tho' not the ſame with this, for that I know few natural things both of *Animals* and *Vegetables*, but what have divers ſorts of the ſame kind, in the ſame Place.

I am aſſured by ſome, who have boil'd, dreſt and eaten of this Fiſh, that they are wholſome Food; as good at leaſt, and taſte as well as *Lympets* or *Winkles*, only the Fleſh is ſomething harder.

Perhaps this colouring Juice may be the ſpermatick and prolifick Matter, by which they propagate their Kind: which I am inclinable to think, from its Conſiſtence, Virulent and Fœtid Savor. Or elſe it may be a Humour in this Animal, which by its vital Energy, as the Spring of Life and Motion, ſupplies the Want of *Heart*, *Liver*, *Blood*, &c. as in other exſanguineous Animals.

There are many ſorts of this *Purple Fiſh*, differing in Bigneſs, Structure, Colour of the Shell, according to the Nature of the *Sea Grounds*, Depth or

Shallowneſs of *Water*, *Rocks*, *Gravel*, *Mud*, as alſo the Latitude, where they are found; and ſo differing alſo in the *Varieties* of *Colours* of the *Tinging Juice* in their Veins, as *Black*, *Livid*, *Violaceous*, *deep Sea-green*, *Light* and *deep Red*, *Amethyſtine*, *&c*. But the beſt of all were found in the *Tyrian Seas*, near that Iſland on which the renowned City of *Tyre* was built, (now an inconſiderable Town called *Sur*; this was celebrated and Priz'd above all the reſt, for that it excell'd them all in its illuſtrious Colour, called in former Ages by divers Names; as *Oſtrum*, *Sarranum*, *Pelagium*, *Venenum*, *Tyrium*, *Purpuriſſum*, *Flores Tyriani*, *&c*. Almoſt all Authors agree, that it lies in a certain Vein in the *Fiſh*; and ſome of them mention it to be white and viſcous, as this of ours is. This excellent *Dye* ſeems to have arrived at its higheſt Perfection in the Days of *Pliny*, (being in the Reigns of the *Veſpaſians*) when the Artiſts of the Imperial City of the World, in Preparations of that *Tinging Succus* for *Dying* the Robes and other Veſtments of *Emperors*, *Senators*, &c. Strove to excell each other in new faſhion'd Purples, to Gratify the Luxuriant Exceſs of the Great Ones of thoſe Times, by Preparing and Mixing the Colour found in the ſeveral ſorts of theſe Shells. Theſe Colours ſold then at great Prices; that which was the fine double dy'd Purple of *Tyre*, called *Diabapha*, yielded 1000 *Roman Denarii* the Pound, which is computed to be more than 30 *l. Sterling*: And this of ours being ſo excellent a Colour, without other Preparation, or Addition of any thing to it, may now, or at leaſt hereafter, by farther Improvement, vye with the *Tyrian Purple*.

Johnſton, out of *Ariſtotle*, mentions a Species of theſe *Fiſhes*, under the Name of *Littoralos qua parva et Flore ſunt rubro*; this agrees with ours, which may be named *Purpura Littoralis*, (*ſive Tenienſis*) *Parva Turbinata*.

LX. *Oct*. 7. 1651. Teſtudinem meam appendi, priuſquam *Latibulum* adiret, ibidem per totam Hyemem *Hybernatura*, pendebatque exacte 4 lib. 3 Un. 7 Dr.

Obſervations on a Tortoiſe by Sir Geo. Ent: n. 194. p. 533.

Oct. 8. 1652. Erutam e Terra Teſtudinem (nam ſe pridie humaverat) appendi denuo, ponderabatque 4 lib. 6 Un. 1 Dr.

Mar. 16. 165$\frac{2}{3}$ *Teſtudo* ſponte e *Latibulo* ſuo prodiit, pendebatque 4 lb. 4 un.

Oct. 4. 1653. *Teſtudo* poſtquam per aliquot dies jejunaſſet, ſubtuſque terram ſeſe abſcondiſſet, inde educta atque appenſa. Ponderabat 4 Lib. 5 Un. Oculi (quos diu Clauſos habuerat) tum aperti plurimum madeſcebant.

Mar. 18. 165$\frac{3}{4}$. *Teſtudo* e Latebris prodiens, & in Lance appenſa, ponderabat 4 lib. 4 Un. 2 Dr.

Oct 6. 1654. *Teſtudo* ad *Hyberna* iturriens pendebat 4 lib. 9 Un. 3 Dr.

Die *Feb*. ultimo 165$\frac{4}{5}$. *Teſtudo* ex *Hyemali* Crypta Prorepens pependit 4 lib. 7 Un. 6 Dr. amiſit itaque Ponderis 1 Un 5 Dr.

Oct. 2. 1655. *Teſtudo Hyematum* itura, pependit 4 lib. 9 *Un*. prius autem aliquandiu *Jejunaverat*.

Mar. 25. 1656. *Teſtud*[illegible]*m* e Latebris *Hybernalibus* prodeuntem appendi, eratque 4 lib. 7 Un. 2 Dr.

Sept. 30. 1656. *Teſtudo*, ſubtus terram ituriens, pendebat 4 lib. 12 un. 4 dr.

Mar. 5. 165$\frac{6}{7}$. *Teſtudo*, de ſubtus Terram exiens, pondo erat 4 lib. 11 Un. 2 Dr. ſs.

Unde ſatis liquet quam Fixis Particulis hæc Animalia, quæ ſub Terra ſe muniunt adverſus *Frigus Hybernum* conſtent; cum per tot Menſes tam exigua pars Corporis in Sudores aut Effluvia abeat, ut an vivent necne, dum hunc in modum ſepulta jacent, merito ambigatur.

A Tortoiſe living 3 days without a Head, by M. ... n. 26 p. 480.

LXI. S. *Steno* writes from *Florence*, that a *Tortoiſe* had its Head cut off, and yet it was found to move its Foot 3 Days after.

A ſort of Oyſters in Eaſt India, by M. Witzen, n. 203. p. 871. Fig. 230. By Dr. *Liſter*, ib. p. 872.

LXII. 1. In the River of *Goa*, there is a Shell repreſented in *Fig*. 230. which holds a ſort of *Oyſter*, it is very ſcarce, and in the *Indies*, as well as here in *Holland*, the Shell powder'd is eſteemed a good Medicine.

2. The like ſort of *Oyſter ſhells* is to be found in the *Weſt Indies*. And conſidering the Hint given us by M. *Witzen*, of its being thought medicinal at *Goa*, where it is found; and alſo how that calcined Shells are the moſt common Entertainments all over the *Indies*, chewing them all Day long with the Leaves of a certain hot, piperate, and ſpicy Plant, and a ſort of Nut mixt therewith; we may reaſonably ſuſpect the *Goa Stone* to be made up of them, or ſuch like Ingredients.

Shining Worms in Oyſters, by M. Auzaut n. 12. p. 203.

LXIII. 1. M. *Auzaut*, at the Intimation of M. *de la Voye*, obſerved a ſhining, clammy Moiſture in *Oyſters*, which ſtuck to the Shell, and being drawn out, ſhone in the Air its whole Length, which was about 4 or 5 Lines, and being put upon the Obſerver's Hand, continued to ſhine there for ſome time. And afterwards cauſing more than 20 Dozen of Oyſters to be opened in the Dark, he found this ſhining Subſtance to be really *Worms*, (as M. *de la Voye* had thought them before) and thoſe of 3 Sorts; one ſort was whitiſh, having 24 or 25 Feet on each ſide, forked, a black Speck on one ſide of the Head, taken by him for a Chryſtalline, and the Back like an *Eel* ſtript off her Skin; the ſecond was red, and reſembling the common *Glow-Worm*, found at Land, which folds upon their Backs, and Feet like the former, and with a Noſe like that of a Dog, and one Eye in the Head; The third ſort was ſpeckled, having a Head like that of a *Soal*, with many Tufts of whitiſh Hair on the Sides of it.

2. The Obſerver alſo ſaw ſome much bigger, that were *Grayiſh*, with a Big Head, and 2 Horns on it, like thoſe of a Snail, and with 7 or 8 Whitiſh Feet: But theſe though kept by him in the Night, ſhined not.

3. Th

3. The 2 firſt ſorts are made of a Matter eaſily reſoluble, the leaſt ſhaking or Touch, turning them into a Viſcous and Aqueous Matter, which falling from the Shell, ſtuck to the Obſerver's Fingers, and ſhone there for the ſpace of 20 Seconds ; and if any little Part of this Matter, by ſtrongly ſhaking the Shell, did fall to the Ground, it appeared like a little piece of Flaming *Brimſtone*, and when ſhaken off nimbly, it became like a ſmall ſhining Line, which was diſſipated before it came to the Ground.

4. This ſhining Matter was of different Colours ; ſome whitiſh, ſome reddiſh, but yet they both afforded a Light, which appeared a *Violet* to this Obſerver's Eye.

5. He obſerved among them 2 more firm than the reſt, which ſhone all over ; and when they fell from the *Oyſter*, twinkled like a great Star, ſhining ſtrongly, and emitting Rays of a *Violet Light* by turns, for the ſpace of 20 Seconds. Which Scintillation the Obſerver imputes to this, that thoſe Worms being alive, and ſometimes raiſing their Head, ſometimes their Tail, like a *Carpe*, the Light increaſed and leſſened accordingly ; ſeeing that when they ſhone not, he did, viewing them by a Candle, find them Dead.

6. Forcibly ſhaking theſe *Oyſter-ſhells* in the Dark, he ſometimes ſaw the whole Shell full of Lights, now and then as big as a Fingers End, and abundance of this clammy Matter, both red and white, which he judges to have been *Worms* burſt in their Holes. And in the ſhaking he ſaw all the Communications of theſe little Verminulous Holes, like to the Holes of Worms in Wood.

7. In more than 20 Dozen of *Oyſters*, he took no Shell (10 or 12 excepted) but it emitted Light; and he found ſome of this Light in 16 of the *Oyſters* themſelves.

8. This Light occurs more frequently in big than ſmall *Oyſters* ; in thoſe that are pierced by the Worm, oftner than in thoſe that are not : and rather upon the *Convex Side* than the other ; and more in freſh ones than in the Scale.

9. Having ſomewhat ſcaled the *Convex Side* of the Shell, and diſcovered the Communication of the Holes, wherein the often mentioned viſcous Moiſture that has any Form of Inſects is found, he ſmelt a Scent that was like the Water of a ſqueezed Oyſter.

10. The *Worms* give no Light when irritated, but if they do, the Light laſts but a very little Time ; whereas that which appears in thoſe that were not angred before, continues a great while ; the Obſerver affirming to have kept of it above two Hours.

LXIV. The *Pearl-ſhells* in *Norway*, and elſewhere, do breed in ſweet-Waters. Their Shells are like to thoſe, which commonly are called *Muſcles*, yet they are larger. The Fiſh in them looks like an *Oyſter*, and it produceth a great Cluſter of *Eggs*, like thoſe of *Craw-fiſhes*, ſome white, ſome black, The Origin of Pearl, by M. Chriſtop. Sandius, n. 101. p. 11.

(which latter will yet become White, the outer *Black Coat* being taken off; theſe *Eggs* when ripe, are caſt out, and being caſt out, they grow, and become like thoſe that caſt them. But ſometimes it happens, that one or two of thoſe Eggs ſtick faſt to the ſides of the *Matrix*, and are not voided with the reſt. Theſe are fed by the *Oyſter* againſt her Will, and they do grow, according to the Length of Time, into Pearls of different Bigneſſes, and imprint a Mark both in the Fiſh and the Shell, by the Situation, conform to its Figure.

This Account I received from a *Dane*, called *Henricus Arnoldi*, an ingenious and veracious Perſon, having by his own Experience found it ſo at *Chriſtiana* in *Norway*, and with great Seriouſneſs aſſured me of the Truth thereof.

Pearl Fiſhing in Ireland, by Sir Rob. Redding, n. 198. p. 659.

LXV. There are 4 *Rivers* in the County of *Tyrone*, abounding with that ſort of *Muſcles*, wherein *Pearls* are found, all emptying themſelves into *Lough Foyle*, whereon ſtands the Town of *Derry*, and ſo into the Sea. There are alſo other Rivers in the County of *Donegall*, a River near *Dundalk*, the *Shure* running by *Waterford*, the Lough called *Lough-Lean* in *Kerry*, which afford the like Fiſh; and do doubt, there be many more that I do not know.

In the warm Months before Harveſt is ripe, whilſt the Rivers are low and clear, the poor People go into the Water, and ſome with their Toes, ſome with Wooden Tongs, and ſome by putting a ſharpened Stick into the opening of the Shell take them up, and although by common Eſtimate not above one Shell in a Hundred may have a Pearl, and of theſe Pearls not above one in a Hundred be tolerably clear, yet a vaſt Number of fair merchantable Pearls, and too good for the *Apothecary*, are offered to Sale by thoſe People every Summer Aſſize. I my ſelf ſaw a Pearl bought for 50 *Shill.* that weighed 36 *Carats*, and was valued at 40 *l.* and had it been as clear as ſome others produced therewith, it would certainly have been very valuable. And a Miller took a *Pearl*, which he ſold for 4 *l.* 10. *Shill.* to a Man that ſold it for 10 *l.* to another, who ſold it to the late Lady *Glenawly*, for 30 *l.* with whom I ſaw it in a Necklace, ſhe refuſed 80 Pound for it from the late Dutcheſs of *Ormond*. The young *Muſcles* never have any Pearl in them.

The Natives, though very foul Feeders, will not eat the Fiſh; which ſeems to me to cut like the *Oyſter*, *blackiſh green*. The Shell is faſtened with 2 Tendons, one at each End, whereas the *Oyſter* and *Scallop* are with one only in the Middle. They lie in Part opened, putting forth their White Fins, like a Tongue out of the Mouth, which directs the Eye to them in the Water, being otherwiſe black as the Stones in the River. The *Backs* of the *Shells*, juſt about the Hinges, on which the *Valves* do open, are all broken and bruiſed both Young and Old, and ſhew the ſeveral Cruſts and Scales that make the Shell; and is cauſed (I think till I know better) by the many great Stones that are driven over them by the Floods from the Neighbouring Mountains, which are moſt Impetuous after any little Rain. The Inſides of the Shells are of an *Oriental* and *Pearly* Colour and Subſtance, like a flat *Pearl*, eſpecially when firſt opened; and I was told by an Ingenious Perſon, living upon the Place; that he had Obſerved in ſome *Shells* under the firſt Coat a Liquor that was very *Orient* and *Clear*, that would move upon the Preſſure of the Finger; but that ſuch a *Muſcle* never had *Pearl*; which Liquor I ſhould think was the true *Mother of Pearl*.

The Part where the *Pearl* lieth is in the *Toe*, or leſſer end, at the Extrimity of the Gut, and out of the Body of the Fiſh between the two *Films*, or Skins, that Line the Shell. I believe that this *Pearl* anſwereth to the Stone in other *Animals*; and certainly like that encreaſeth by ſeveral *Cruſts* growing over one another, which appeareth by Pinching the *Pearl* in a *Vice*, the upper Coat will Crack and leap away; and this Stone is caſt off by the *Muſcle*, and a voided as it is able; and many Shells that have had *Pearls* in them, are found now to have none; which will appear by theſe Inſtances; the Shells that have the beſt *Pearls* are Wrinkled, Twiſted, or Bunched, and not ſmooth and equal, as thoſe that have none. And the Crafty Fellows will gueſs ſo well by the Shell, that though you Watch them never ſo carefully, they will open ſuch Shells under the Water, and put the *Pearls* in their Mouths, or otherwiſe conceal them. Yet ſometimes when they have been taking up Shells, and believing by ſuch Signs as I have mentioned, that they were ſure of good Purchaſe, and refuſed good Sums for their Shares, they found no *Pearl* at all in them. Upon Diſcourſe with an Old Man that had been long at this Trade, he adviſed me to ſeek not only when the Waters were low, but in a Dusky Gloomy Day alſo, leaſt, ſaid he, the Fiſh ſee you, for then he well ſhed his *Pearl* in the Sand; of which, I believed no more, than that ſome *Muſcles* had voided their *Pearls*, and ſuch are often found in the Sands.

I conceive that theſe *Pearls*, if once Dark, will never be Clear upon any Alteration in the Health or Age of the *Muſcle*, or of the Moon; and that if the firſt Seed be black, all the Coats ſuperinduced will be ſtill *Clouded*.

The bottoms of theſe Rivers I obſerved to be part *Sandy*, part *Stony*, and part *Ouzy*. Many of theſe *Muſcles* lie in Brackiſh Water; being driven down the Rivers 4 or 5 Miles within the *Flowing* of the Sea. I have ſometimes obſerved the ſame *Pearl* Clear at one End, and Dark at the other.

LXVI. *Pectinem* nactus, ineunte *Januario*, ejus Diſſectionem, qua potui accuratione, certe ex uno Exemplari, inſtitui. Imprimis vidi *Cardinem* ex *Concava valva* leviter incurvari, & ſuperinjici alteri ac *Plana Valva*, totoque illo latere inter ſe *Cartilagine* quadam firmiter connecti: Item in ipſo medio ſpatio *Cardinis* alteram Aterrimam Robuſtamque admodum *Cartilaginem* diſponi. Hinc adeo mira illa Conſtrictionis vis, & fortaſſe *Planam Valvam*, Remi alicujus more, movendi, adque Pernicitatem & volatus quandam imaginem moliendam, de quo quidem non ſemel loquuti ſunt veteres tanquam huic *Conchilio* peculiari.

The Anatomy of a Scallop; By Dr. M. Liſter. n. 229 p. 567.

Apertis autem *Valvis* hæc conſpicienda ſeſe exhibent. Ad Dextram & ſub *Cardine* Os Cucullatum, inſtar *Oſtreæ*. Velamina autem *Oris* conficiuntur ex Concurſu *Branchiarum* Exteriorum, quæ *Muſculoſæ* ſunt; totumque Animalis *Caput* ad *Ani* exitum, ſcilicet ſiniſtram verſus a regione *Oris*, ubi inter ſe rurſus connectuntur, circumambiunt.

Ex illo autem Pari *Branchiarum* Exteriorum ea quæ *Planæ Valvæ* incumbit, *Centro* ſuo adhæret ſuperiori Limbo ingentis cujuſdam *Muſculi* Rotundi, qui ex Rectis Angulis in Mediis *Valvis* inſeritur: Altera vero exterior *Branchia* ſimiliter conjungitur, alteri Capiti ejuſdem *Muſculi Centralis*.

A *Muſculo* vero *Centrali* Ambæ iſtæ Exteriores ſive Spuriæ *Branchiæ* e Tenui *Membrana* & Pellucida admodum conſtant, & ad Medias *Valvas* expanſæ, leviter iis adhærent, ut moveri inde non poſſint, tuenturque *Animalis Dorſum* ab Aquæ Injuria, intra *Valvas* receptæ; a loco vero iſtius Adhæſionis, Craſſus quidem *Muſculus* Mirificus, tanquam Limbus, incipit: Is autem a me Depingitur tantum eo quo contrahitur modo, ſed in *Vivis* mire Extenſilis eſt, etiam longe ultra *Margines Valvarum*. Ipſe Laciniis donatur, & ex *Rufo* variatur Lineolis Elegantiſſimis. Multis autem Diebus a Piſcatione noſtri *Pectinis* is Limbus haud obſcure movebatur. *Uſum* autem ejus ſic intelligo, nempe ex Contractione Incurvata Introrſum, more Retis cujuſdam, cum ambo iſti *Branchiati Muſculi* extra *Concham* emiſſi ſint, quicquid inter ſe complexi fuerint, ſibi mutuo applicati, ad ſe rapiunt in *victum Animalis*. Laciniis autem, extremis iſtis Marginibus tenuiter inciſis, Aqua *Marina* ſeparari videtur, retento *Cibo*. Si qui vero ſint alii ejuſdem Partis *Uſus*, me latent. Illud tamen addere lubet, hunc *Limbum* poſſe inſervire etiam *Necationi* cujuſlibet *Animalis* Minuti aut *Piſciculi*, ex forti Compreſſione; itemque ex *Motu Undulatorio*, qui in eo valde Notabilis eſt, poſſe circumferri victum; cumque tandem, quacunque Parte *Circuli Retiarii* ſit, ipſi *Ori* exporrigi, ita *Manus Locum* quodammodo ſupplet.

Ad Veras autem, certe quæ ita appellari ſolent, *Branchias* venio, hæ vero quatuor ſunt leviter *Flavicantes*, atque Pectinatim ſtriantur Eleganti quodam opere. Illæ autem *Branchiæ Muſculum* magnum *Centralem* circumambiunt, interque ſe comprehendunt ſive incumbunt *Utero*, ejuſque *Ovario*, certe *Partibus Generationi* dicatis. Harum autem Partium *Figuræ* recte a me ante Delineatæ fuerunt, & jam *Vivo* quoque *Animali* video ejus partem inferiorem ex *Croca* reſplendere; Superiorem vero *Albicare*; juxta *Os* vero Proceſſus quidam, Duplici *Foramine* apertus, conſpiciendus eſt. Horum autem *Foraminum* Unum, *Vulvæ* Exitus Exiſtimandus eſt; & ſi *Androgyni* ſint *Pectines* (quod ſuſpicor ex perpetua ſimilitudine iſtius Partis in omnibus a me viſis, & vivo & Conditis) *Alterum*, ad *Maris* Genitale Membrum exerendum inſtituitur.

Ad *Caput* procedo; Huic *Os Labiis* circumſcriptum eſt *Rufeſcentibus*, more *Branchiarum* Internarum; & Brevibus admodum, & in noſtro Exemplari Criſpis, forte vitioſis & mutilatis. Sub ipſum vero *Cardinem* medium duo prægrandes veluti *Circuli* ſive Cavitates inſtar *Oculorum* (ut *Oculi* non ſunt) alicujus *Rhombi* Piſcis, oblique poſitorum.

Os vero *Caputque* excipit Majuſculum *Meconium Subnigrum*, ad ſiniſtram vergens. Pone id *Cor* latitat, perque ipſum *Pericardium* Pellucidum conſpici poteſt; ex carneo leviter *Rufeſcit*. *Cordis Aorta* in *Branchias* diſpertitur. An vero id ſolum *Pericardium* ſit, quod ſcilicet proxime adjacet *Nigro Meconio*, ſive totum etiam illud Figura *Rhomboide* comprehenſum, hæreo. An pars ejus inferior *Veſica Urinaria* ſit, quæro: Certe ex *Meconio* oritur *Inteſtinum Rectum*, ſuperque *Pericardium* equitans, ad *Internas Branchias* protenditur, & *Muſculo Centrali* adnectitur.

Muſculus autem *Centralis* Orbicularis eſt, *Albus* & Lævis magna ſuperficiei ſuæ parte, qua *Concha* adhæret; ex ſiniſtra vero parte, alio *Candidiori Muſculo* lacerato diſtinguitur, & *Concha* magis formatur.

aaa. *Os*, *Caputque* *bb.* *Meconium Aterrimum* *c.* *Cor*, prout ſubter Membranam latitat. *dd.* *Pericardium*, an *Veſica Urinaria Rhomboides eeee.* *Inteſtinum Rectum Pericardio* ſuper equitans. *fffff.* magnus *Muſculus Centralis* *gg.* alius *Muſculus* laceratus *Teſtis* fortiter adhærens. *hhhh.* *Branchiæ* Internæ. *ii.* *Uteri* prælongati Exitus, duobus *Foraminibus* diſtinctus tanquam in *Androgynis*. *kk.* *Uteri* pars ſuperior *Albida*. *llll.* *Uteri* pars Inferior *Crocea*. *mmmmm.* *Limbus Variegatus*, ſive *Muſculus Retiarius Secundus*.

Explication of the Figure.

Fig. 231.

LXVII. There are found on the Coaſts of *Malabar* and *Ceylon*, certain *Cockles* or *Shells*, in *Dutch* call'd *Kouk-horens*. Theſe *Shells* contain a Fiſh that lives in the bottom of the Sea, fixt in the Body of the Shell, and at a certain Seaſon of the Year, they caſt their Seed, which produces a ſort of *Matrix* of the ſize of the *Figure*. This long Body which is Wrinkled like an *Andouille*, or *Sauſage*, is fill'd with a great Number of Round Cells, which are ſo many *Matrices*, each producing its little *Shell-Fiſh*, which quit not their Cells till they are grown to ſuch a bigneſs and Maturity, as their Weight breaks them off, and looſens them from their Cells, and ſo from their common *Matrix*, which remains faſtened to the bottom of the Sea by the great End, the other End moving about freely in the Water, which is flexible every way like an *Andouille*. It is obſervable that this *Matrix* has a kind of Back-part and Belly; the Back is ſomewhat like that of a *Schelois*, and of a Grayiſh Colour, the Belly is Whiter, and is that part which is fill'd with the Cells from one End to the other: The Skin which covers it is very like that of *Stock-Fiſh* or other dryed Fiſh.

A [illegible] Cockles in East India, By Mr. Witzen. n. 203. p. 870.

Fig. 232.

LXVIII. The Stones in the Heads of *Craw-Fiſh* are always on the outſide of the Stomach, while the *Old Coat* ſticks on the Back of the Fiſh and paſs into the Stomach as ſoon as they caſt their Coats; I never ſaw them on the outſide, when they have Changed, nor within before.

I have obſerved that the *Males* of *Craw-fiſh* change their Coats a conſiderable time before the *Females*; for they always keep theirs till they have parted with their Young from their Tails.

Stones *in the* Heads *of* Craw-fiſhes, By Mr. Ch. King. n. 266. p. 672.

Cancelli, *or* Soldiers; *By* Mr. Will. Cole. n. 178 p. 1884.

LXIX. Thoſe who ſhall ſeek after the Purple-fiſh will find, as I have done, ſome of thoſe *Shells* in which are the *Cancelli*, or rather *Aſtaci*, unto which they are more like, and ſo may Miſtake: For thoſe little Crabs, or Craw-Fiſhes, I have found in moſt of our *Engliſh* Shells, excepting the *Bivalved*, and *Patella* s. Of theſe Fiſhes in many parts, (eſpecially in the *Weſt Indies*,) there are many ſorts, and ſome very large, which our Country Men there call the *Soldiers*; for that they ſay, the enter by force, kill and take Poſſeſſion of thoſe Houſes they have not built; and when they grow too big, forſake them and enter into larger. Whether that be true, I know not, but this I have found, when I have broken ſome of the *Shells* in which thoſe *Vagrants* are, ſo as not to Bruiſe their Bodies, and then put them Naked into the Water, I have beheld them with nimble ſpringing Motion, to Run to and fro till they find a Stone to hid themſelves under; which not finding, they bury themſelves in the looſe Sand. This Obſervation gave me full ſatiſfaction, that they were not (at leaſt all the kinds,) *Connate* and *Coaleſcent* with their *Shells*; as other *Teſtaceous* Animals of the Sea and Land are.

Vid. Sup. §. LIX.

A Stellar-Fiſh; *By* Mr. Winthrop. n. 57. p. 1151. n. 74. p. 2221

Fig. 233.

LXX. 1. I underſtand by the Fiſher Man who brought me this Fiſh, that he never ſaw, nor heard of any but 6 or 7 that were taken at ſeveral times by himſelf, not far from the *Shoals* of *Nantucket* (which is an Iſland upon the Coaſt of *New England*) when he was Fiſhing for *Cod*. This *Stellar-Fiſh*, when it was alive, and firſt pulled out of the Water, was like a Basket and had gathered it ſelf round like a Wicker-Basket, having taken faſt hold upon that *Bait* on the Hook which he had ſunk down to the bottom to catch other Fiſh, and having held that within the ſurrounding *Brachia*, would not let it go, tho' drawn up into the Veſſel; until by lying a while on the Deck, it felt the want of its Natural Element, and then Voluntarily it extended it ſelf into a Flat Round Form. The only uſe that could be diſcerned of all that Curious Compoſure, wherewith Nature had adorned it, ſeems to be, to make it as a Purſe-Net to catch ſome other Fiſh, or any other thing, fit for its Food; and as a *Basket* of Store to keep ſome of it for future ſupply; or as a *Receptacle* to prepare and defend the Young Ones of the ſame kind from Fiſh of Prey, if not to feed on them alſo (which appears probable the one or the other;) for that ſometimes there were found pieces of *Mackarel* within that Concave: And he told me, that once he caught one, which had within the *Hollow* of its Embracements a very ſmall Fiſh of the ſame Kind, together with ſome piece or pieces of another Fiſh, which was judged to be of a *Mackarel*.

He told me that every one of the ſmalleſt Parts had Motion when it was alive, and a Tenacious Strength; but after it was Dead and extended to a flat Round, it was ſo Brittle that it could not be handled without breaking ſome Parts of it; but by carefully laying it to dry, it was ſomewhat hardned. I *think* (till a fitter *Engliſh* Name may be found for it) that it may be call'd a *Basket Fiſh* or a *Purſe-Net-Fiſh*.

2. This Elaborate Piece of Nature we may call *Piſcis Echino-Stellaris Viſciformis*, its Body (as was noted by Mr. *Hook*) reſembling an *Echinus* or *Egg-fiſh*, the *Main Branches* a *Star*, and the *dividing* of the *Branches*, the Plant *Miſſel-toe*. This Fiſh ſpreads it ſelf from a *Pentagonal Root*, which encompaſſeth the Mouth (being in the middle, at *a*,) into 5 *Main Limbs*, or *Branches*, each of which, juſt at the iſſuing out from the Body, ſubdivides it ſelf into *two* (as at *1.*) and each of thoſe 10 Branches does again (at 2.) Divide into *two* parts, making 20 leſſer Branches: Each of which again (at 3.) Divide into *two* ſmaller Branches, making in all 40. Theſe again (at 4.) into 80; and thoſe (at 5.) into 160; and they (at 6.) into 320, They (at 7.) into 640; at 8, into 1280; at 9, into 2560; at 10, into 5120; at 17, into 10240; at 12, into 20480; at 13, into 40960; at 14, into 81920; beyond which, the farther Expanding of the *Fiſh* could not be certainly Traced, though poſſibly each of thoſe 81920 ſmall Sprouts or Threads, in which the Branches of this *Fiſh* ſeem'd to *Terminate*, might, if it could have been Examined when living, have been found to ſubdivide yet farther. The Branches between the Joints were not equally of a length, though for the muſt part pretty near; but thoſe Branches, which were on that ſide of the Joint, on which the Preceding Joint was placed, were always about a *4th* or *5th* part longer than thoſe on the other ſide. Every of theſe Branchings ſeem'd to have, from the very Mouth to the ſmalleſt Twigs or Threads, in which it ended, a double Chain or Rank of *Pores*, as appears by the Figure. The Body of the Fiſh was on the other ſide, and ſeemed to have been Protuberant, much like an *Echinus*, or *Egg-fiſh*, or *Button Fiſh*, and like that divided into 5 Ribs or Ridges, and each of theſe ſeem'd to be kept out by two ſmall Bony Ribs. *NS.* In the Figure is repreſented fully and at length, but one of the Main Bronches, whence 'tis eaſie to imagine the reſt cut off at the *4th Subdividing Branch*; which was done to avoid Confuſion.

By —— n.37.p.1153

Fig. 233.

3. This *Star-Fiſh* is the *Stella Arboreſcens Rondeletii*; Firſt deſcribed by him, and ſince by other Naturaliſts.

By Mr. Fran. Willoughby. n.58.p.1200

LXXI. 1. In *Decem.* 1696. Two remarkable *Marine Animals* were found in the Stomach of a Common *Cod Fiſh* ſold in the *Fiſh Market* in *Dublin*. One of them by lying long in the Stomach was much Mangled and in part digeſted: But the other was Compleat in all its Parts, and had received no manner of Alteration, ſave 'twas Dead. It was bigger at one End, and went Taper or gradually leſſening towards the other. It was 4$\frac{6}{10}$ Inches long; and where largeſt, as it was 1$\frac{1}{10}$ Broad, ſo it was about 3$\frac{1}{2}$ Inches in Circumference: At the ſmaller End, not above $\frac{4}{10}$ of an Inch Broad. It had neither *Shell*, *Cruſt*, *Scales*, or *Bone*, for its Covering, but was ſoft: Yet not Flabby, or Fleſhy, as the *μαλακία*, or *Mollia*, but rather Membranous.

A Scolopendra Marina, By Dr. Tho. Molineux. n. 225. p. 405

Fig. 234, 235

The Back or upperſide, was ſhaped Roundiſh, eſpecially towards the ſides; In the middle it was ſomething flattened, the Belly was perfectly Plain. Along the middle of the Back ran a large *Stripe* from one extream to the other,

Fig 234.

ther about $\frac{3}{10}$ of an Inch broad, towards the upper End, but ſtill narrower as it came towards the Tail. This *Stripe* was all covered with a ſhort ſoft ſort of *down*, not unlike in Texture, Colour, and Subſtance, to that which grows on the *back* of the *Leaf* of *Tuſſilago* or *Colts-foot*. Joining to the Edge of this *Stripe*, ran from one End to t'other, a Liſt about $\frac{3}{10}$ of an Inch broad, that covered both ſides of the Animal, and part of his *back*. This Liſt or Verge, was thickly ſhagged, with a fine ſoft Hair that grew very *thick*, and about $\frac{1}{4}$ of an Inch long; of a moſt delicate Changeable Red and Green Colour, and of ſo ſparkling and vivid Luſtre, that nothing of this kind could ſhew more Beautiful. Among this ſoft Hair were thickly interſperſed, without order, an abundance (ſome *Hundreds*, I believe) of black ſharp, hard Prickles, about the ſame length of the Hair, and the thickneſs of a *Hog's Briſtle*, but much harder, and very ſharp at the Points. The Tail, or ſmaller End, terminated in the *back*, with *two Triangular* Pellucid ſoft *Scales*, that covered the Orifice of the *Anus*, at which its Excrement was diſcharged; as I found when I opened it, for the Extremity of the *Inteſtine* was cloſely inſerted into this Paſſage.

Fig. 235. The bigger End, tho' it had not any *Horns*, *Eyes*, *Ears*, *Noſe*, or *Gills*, yet becauſe 'twas oppoſite to the *Tail*, and here was the Mouth we may properly enough call the Head. The Mouth was a very large Patulous Opening, for the *bulk* of the *Animal*; not placed at the end, but ſomewhat underneath, as part of the Belly, and could not be ſeen when the *back* was turned uppermoſt. The Belly was flat, and no ways Protuberant, covered with a ſmooth naked Skin, of a much lighter Colour than the *back*, irregularly *Spotted*, with little *dark browniſh Spots*, ſome larger ſome ſmaller: 'Twas broader towards the Head, and grew *narrower* ſtill towards the Tail; where for above the ſpace of an Inch, it was curiouſly Pinched with little *Indentures*, reſembling the ſmall Joints in the *Tails* of ſome *Inſects*. Theſe Diviſions, or Joints, were ſtill ſhorter and cloſer to one another, the nigher they were to the Extremity of the *Tail*. Beginning cloſe at each Corner of the Mouth, and ſo along both ſides of the Belly, was Ranged a *Row* of Feet, in a cloſe continued Series down to the utmoſt tip of the *Tail*. The largeſt were placed towards the Mouth, and upper part of the Body, where they were about a Quarter of an Inch long, but *downwards* they *grew* leſs and ſhorter, ſtill gradually diminiſhing, the nearer they approached the end of the *Tail*; where they were ſo Minute, that they were inſenſibly loſt, and not eaſily to be diſtinguiſhed by the *Eye*. I diſtinctly counted, from the Mouth to the Tail, on one ſide 36, and I could not be poſitive but there might be ſtill more. From within the Body, though the middle of each Foot, paſs 4, 5, or 6 of the ſame ſort of ſharp hard Prickles, that were interſpers'd amongſt the ſoft Hair. Theſe were larger or ſmaller, and more or leſs in Number, according to the Size of the Foot, and give it ſtrength and firmneſs inſtead of *Bones*: And likewiſe iſſuing forth beyond the End of the Foot, ſerves in lieu of *Toes*, or *Claws*. Joining to this *Row* of Feet, towards the *back* was Ranged along each ſide in a direct Line, a Series of ſmall, thin, ſoft,

flat Fins, Face to Face in ſuch an Order, that each *Foot* was exactly anſwered by its Correſpondent Fin; ſo that their Number was preciſely the ſame with that of the *Feet*, and they kept the ſame Rule of Proportion of their Size, ſtill gradually diminiſhing, the nearer they approached towards the *Tail*. I diſtinctly counted of theſe, as of the Feet, 36 of a ſide; each Fin was curiouſly Fringed at the Edge, with the ſame Beautifully Coloured Hair, I before mentioned to have covered the Sides and part of the Back. By help of theſe *Fins* it performed *Progreſſive* Motion through the Water as a Fiſh; and by means of the *Feet* could *Creep* along the bottom of the Sea, as a *Reptile*.

When I open'd it, I found a thin *Membranous Gullet*, that led from the Mouth to the Stomach, about an Inch long. From this was continued ſtraight *downwards* the Stomach, of a Whitiſh Colour, and of a tough thick Texture, conſiſting of an outward and inward *Membrane*, with a ſort of *Carneous* Subſtance between; reſembling ſomewhat in make, tho' not in Figure, the *Gizard* in ſome *Fowl*; 'twas as large as the upper Joint of a Man's little Finger. To this was annext the *Inteſtine*, of a very differing Colour and Subſtance from the *Stomach*; for 'twas Reddiſh, Soft and Tender, and of a much ſmaller Cavity; 'twas continued almoſt directly, or with little Circumvolution, to the *Anus*. The *Brain*, *Heart*, *Gills*, *Liver*, or *Parts* for *Generation*, (if they have any) were hardly, if at all, to be diſtinguiſhed.

The Muſcular Parts were very Curious, Large and Diſtinct. One long continued *Stripe* of *Red Fleſhy Fibres*, about the Sixth part of an Inch broad, ran directly along the middle of the *back*, from the Head down to the *Tail*. This Fleſhy Stripe ſent out from each ſide, like ſo many Rays, 36 ſeveral Pair of ſmaller lateral Muſcles, which by the conſiderable Interſtice between, I could eaſily diſtinguiſh from each other; making ſo Regular a Figure all together, that they might very aptly be reſembled to the *Spine*, or *Backbone*, of the *Paſſer Marinus*, or common *Plais* Fiſh, when it is entire with all its Ribs, or *Tranſverſe Proceſſes* iſſuing by *Pairs* from both ſides of each *Vertebra*, from the Head down to the *Tail*. In this manner every particuar Foot and Fin were ſupplied with their Correſpondent Muſcles, to give hem Motion, either together or apart, as the Neceſſity or Deſign of the Animal required. And moreover, conſidering this ſort of Muſcular Mechaniſm, with the Taper ſhape of the Body, and likewiſe the Poſture and uſe of the many *Prickles* interſperſed among the *Hairy Shag* that covered the ſides; it ſeems very evident to me, that beſides its *Progreſſive* Motion, it had alſo the Power, (as have moſt of the Many-footed Land Reptiles, and ſome *Water Inſects* I have obſerved) of Contracting its Body in ſuch a way, that bending its Head Inwards, it roll'd the reſt of the Body Round it as a Center, making a Figure like a Rope Coil'd into a *Helix*; and in this Poſture, beſet almoſt quite round with *Sharp Prickles* ſtarting out directly forward, it guarded it ſelf from Violences that might Annoy it.

Ooooo 2

This Animal, on many Accounts, I think may properly be Ranged with the *Scolopendra Marina* deſcribed by *Rondeletius*; but it may be diſtinguiſh'd from them by calling it *Scolopendra Marina a Capite Latiori verſus Caudam ſenſim gracileſcens, Limbo Pulcherrimo Hirſuto Spinuliſque crebris interſtincto e Mari Hibernico.*

Explication of Figures. 234. and 235. *a a a a a.* The *Downy List* that runs along the *Back*; *bb* the two *Triangular Scales* that cover the *Anus*, *c c c c c c c c.* the *Verge* of fine *Changeable Green and Red Hair* that covered the ſides, and part of the *Back*; *d d d d d d.* the hard ſharp *Prickles* interſperſed among the *Hair*; *e e e e.* the *Skin* of the *Belly*; *f f f f.* ſeveral *Inciſures* reſembling *Joynts* towards the *Tail*; *g g g g g.* *Darker Spots* in the *Skin* of the *Belly*; *h h h h h.* the *Feet* of each ſide the *Belly*; *I I I I I I.* the Fins with their *Hairy* Fringe behind the *Feet*; *k k.* the large Mouth opened Wide.

By Mr. Dale, n. 254. p. 51. 2. I obſerved at *Harwich* in 1698. divers of theſe Marine Animals brought up by the Fiſhermen, which they call *Sea-mice.* They are deſcribed by *Rondeletius*, and by *Moufett* and *Johnſon*) Figured under the *Title* of *Phyſalus*, but badly.

By Dr Molyneux, n. 251 p. 127. De Piſcibus, L. 15. p. 429. 3. I think if we'll ſuppoſe that *Rondeletius* ſaw what he Deſcribes under the *Title* of *Phyſalus*, we can't imagine that he and I had the ſame Object before us. This will appear Evident by comparing his Words with Mine; For he ſays of his Animal *Ore caret*, whereas I ſay, the Mouth of mine was a *very large Patulous Opening for the Bulk of the Animal*; He ſays, *In Medio Latior eſt & Extrema Gracileſcunt, Pudendi Muliebris ſpeciem referens*, whereas I ſay, *twas bigger at one end, and went Taper, or gradually leſſening towards the other*; he ſays, *in Dorſo tumores parvi eminent; Verrucas Piſcatores noſtri vocant*, I am ſure I could obſerve none ſuch, but ſay, *the Back was covered with a ſhort ſoft ſort of Down, in Colour, Texture and Subſtance like that which grows on the Leaf of Tuſſilago*; *Venenatum experti ſumus*, ſays he, whereas I found two of the *Scolopendra*'s I deſcribed in the *Stomach* of an Animal that had devoured them, and digeſted one as its Natural Food and Suſtenance, from whence we may conclude that they are not Poyſonous; and beſides *Rondeletius* his *Icon* agrees exactly with his own Deſcription; whereas it neither agrees with my Deſcription nor my Figure.

Vol. 3. p. 87. But I have lately, in the *Acta Med. & Phil. Haſn.* of *Tho. Bartholini*, met with the Figure of a *Sea-Inſect* under the Name of *Vermis Aureus vel Species Erucæ Marinæ rarior*, which I am confident is the ſame with Mine; tho' *Bartholine*'s *Figure* is Faulty, and the Deſcription ſhort, Falſe, and Imperfect.

De Inſect. L. 5. Cap. 5. And I am apt to think that *Ulyſſes Aldrovandus* deſign'd our *Scolopendra* by the *Scolopendra Marina Lato Corpore Subcaſtaneo velut Pedibus Innumeris longiuſculis Aurei Coloris*; tho' his *Icon* be much worſe than *Bartholine*'s, and requires ſome ſtrength of Phanſy, to gueſs whether it be really ſo or not.

LXXII. At Sir *Juſt. Iſham's*, I lately ſaw 4 very large *Carps* that a Boy took with his Hands in the Heat of the Day: His Way was this, he waded into the Pond, and then returning to the Sides he would grope them out in the Sedge or Weeds, and tickling them with his Fingers under the Belly, quickly removed his Fingers to the Gills, and threw them out upon the Land; and this he did not in a narrow, but large Pond, of about an Acre of Ground. He knows when he is upon the *Carps Layer*, if I may uſe that term, by the Warmth of the Water, and then he immediately repairs to the Sides to purſue his Game.

A way of catching *Carps*, by Mr. J. Templer, n. 95. p. 6066.

I may here note, that *Carps*, and I ſuppoſe, all other Fiſh that keep near the Bottom, keep always in a *Shoal*. And when they move from one place to another, they raiſe the *Mud* in the Heat of the Day; ſo that you may eaſily obſerve, what Road they travel, by muddy Tincture near the bottom of the Water; and that ſo certainly, as you cannot eaſily miſs of covering the greateſt part of them with a *Caſtnet*.

LXXIII. From *Lampert* towards *Bridgewater*, *Eels* are ſo cheap in the Froſts of *Winter*, that they vend them for little. Their Abundance is from hence, that as the People walk in the Froſty Mornings, on the Banks of the River, they diſcern towards the Edges of the Banks, ſome Parts not hoar, as the reſt, but green; where ſearching the Holes of the Banks, they find Heaps of *Eels*.

Eels diſcovered plentifully in *Froſts* in Somerſetſhire, by Dr. J. Beale, n. 18. p. 343.

LXXIV. I have lately met with Relations of two very large *Eels*, caught upon the Coaſt of *Eſſex*, they both had all the *Characterizing Notes* of the *Eel*, and wanted thoſe *Barbles* which the *Eel* ſometimes hath not, but the *Conger* is never without. The firſt was taken ſomewhere about *Crickſea*: Its Length from the Tip of the Noſe to the Tail's End, was 5 Foot 8 Inches; and in Circumference it was 22 Inches. The other was taken in *Maldon Channel*, about a Mile below the Town: the Length of which was 7 Foot: the Circumference 27 Inches, the Weight 36 Pounds, and out of its Belly was taken 5 Pounds of Fat; its Skin was black, and being ſtuft, is ſtill preſerved at *Maldon*. This Fiſh was ſuppoſed to have been brought down thither by the great Floods, at the breaking of the laſt Froſt, becauſe of a Hurt it had on its Back, which the Fiſherman who caught it, told me, he did conjecture might be from ſome Mill it muſt paſs through.

Two very large Eels, by Mr. Dale, n. 238. p. 90.

LXXV. 1. The Reaſon of the Difficulty of Diſcovering the manner of the *Generation* of *Eels*, is the *different Way* of *Generation*, and that they breed in *February*, a time when few are taken but what are preſerved in *Trunks* or *Ponds*, where they breed not. This I examined 2 Years ſince, in ſome taken at a Mill, in which *Holes* they breed, eſpecially near gravelly Shallows; and found one with Egg another with 6 young Ones, in the great *Inteſtine*, which

The Generation of Eels, by Mr. Benj. Allen, n. 231. p. 664.

which I call the *ſtrait Bowel* that Deſcends immediately from the *Pylorus*, until the Winding begins. They were faſtened to very ſmall *Placenta* each, which was fixed to the *Inteſtine*; the *Miſeraicks* at that time were very turgid. The Eggs were on the Outſide of the *Inteſtine*. It is certainly viviparous, and feeds not, at leaſt groſs in the *Winter*; during all which, they lie ſtill till they have diſcharged their Young. The Part diſtinguiſhing the Sex are diſcoverable; thoſe of the Male affix to the Extremity of the *Kidney*; the Female had a ſlender *Gland* tranſverſly lying near the Bowel; but of this I dare not ſay much.

In *Salt-Water-Eels*, I have not found the like, though ſearch'd for; becauſe I am of Opinion, they do not breed, but are the ſame with the *Freſh Water* ones, ſince ſuch Multitudes of freſh Water Eels go down to the Sea, and cannot return, yet are never taken at Sea, among the many brought hither: and there are *Veſtigia* of their Beards in the Freſh Water Ones.

By Mr. Dale, n. 238 p. 92. 2. That the Generation of any Animal cannot be *Equivocal* or *Spontaneous*, but from Animal Parents hath been ſo well by many undeniable Arguments aſſerted, and by multiply'd Experiments confirmed, by thoſe Famous and Celebrated *Virtuoſi*, *Malpighius*, *Redi*, *Swammerdam*, *Leewenhoeck*, Mr. *Ray*, and others, that I think there is no Room to Doubt but that *Eels* have the ſame Original: But it is much diſputed amongſt Learned Naraliſts, whether *Eels* have diſtinct Sex, or are *Hermaphrodites*. Mr. *Allen* affirms, the Parts diſtinguiſhing the Sex to be diſcoverable, but Mr. *Leewenhoeck* could never find any ſuch thing; for all thoſe that he hath diſſected, he Declares, were provided with an *Vterus*: From whence he doth conjecture them to be *Hermaphrodites*, and beſides the *Vterus*, to be provided with *Maſculine Seed*.

Another Controverſy about the Generation of *Eels* is, whether they are Oviparous or Viviparous.

I find many ingenious Perſons, who firmly believe them to be Oviparous but their Sentiments are contrary to the Obſervations of *Walter Chetwynd*, Eſq; who in the Month of *May*, found them to be Viviparous, by cutting open the red Fundaments of the Females, from whence the young Eels would iſſue forth alive.

And although Mr. *Allen* affirms them to be certainly Viviparous, yet his Obſervations concerning the Place of their Conception, I cannot conceive to be conſonant to that Care and Induſtry of Nature, in providing convenient Receptacles for preſerving the *Fœtus*; neither is it agreeable to Reaſon to believe, that when *Nature* hath provided an *Vterus* in all Animals, not only the Viviparous, and ſuch as only cheriſh the *Embryo* in *Vtero*, but in the Oviparous alſo and Inſects, the *Eel*, and *Xiphia*, or *Sword-fiſh*, ſhould be the only Animals without it; much leſs that the Guts, appointed by Nature for the Secretion of Nouriſhment, and the Expulſion of the *Faces*, and are always in Motion, ſhould be the Place of Generation in any Animals, though we may allow *Eels* not to Feed Groſs in the Winter. On the contrary, that the *Eel* hath an *Uterus*, is aſſerted by M. *Leewenhoeck*, who never found them without; which perhaps is that Part which Mr. *Allen* names a ſlender *Gland*, tranſverſly lying near the Bowel.

Beſides, Nature having in all Animals, *Oviparous* as well as *Viviparous*, hitherto diſſected, provided not only an *Uterus*, but alſo *Tubes* (firſt obſerved by *Fallopius*) for the conveying the *Ovum* from the *Ovarium* to the *Uterus*, another great Difficulty and Objection lieth againſt Mr. *Allen*'s Obſervations; and in which indeed he ſeems to contradict himſelf; for whereas he ſaith, that in one *Eel* he found Eggs, and thoſe on the outſide of the *Inteſtine*, but in the other, 6 young Ones, each faſtened to a ſmall *Placenta*, and thoſe within the great *Inteſtine*, how and by what Paſſages, could thoſe Eggs come into the great *Inteſtine*, to be formed and invigorated, unleſs we may ſuppoſe they do, like the *Embryo*'s of ſome ſort of Inſects, which for the Conveniency of Food eat their own way into their *heterogeneous*, or aſſumed *Matrices*.

Obſervations on the Anatomy of a Porpus, by Mr. J. Ray. n.74.p.2220. n.76.p.2274.

LXXXVI. In *April* 1669, at *Weſt-Cheſter*, I met with a young *Porpus*, caught upon thoſe Sands. The Length was 3 Foot 7 Inches; a String of 2 Feet and 2 Inches, girded him in the thickeſt place; the Shape of his Body was not much unlike that of a *Tunny-fiſh*, only his Snout longer and ſharper, his Skin was thin, ſmooth, and without *Scales*; In an old and well grown Fiſh, it's like the Skin may be thick and tough, as *Rondeletius* repreſents it. His *Fins* are *cartilaginous*, and flexible, not ſharp nor prickly, as the Ancients report them. On his Back he hath only one, which was diſtant from the tip of his Snout 1 Foot and 9 Inches, and the *Baſis* of it is in Length 5½ Inches; ſo that meaſuring from the Tip of his Snout to the End of his Tail, it was ſituate ſomewhat below the Middle of the Fiſhes Length. On the Belly it had only 1 pair of *Fins*, 9½ Inches diſtant from the tip of the lower *Mandible*, much about the Place where the foremoſt pair of *Fins* in other Fiſhes uſually grow. The *Tail* is forked, of the Figure of a *Creſcent*, the Breadth thereof from Angle to Angle 11 Inches; and the Plain of it lies parallel to the *Horizon*, as in all others, I ſuppoſe, of the *Cetaceous Kind*; the Reaſon whereof I conceive to be partly to ſupply the uſe of the hind moſt pair of *Fins* in other Fiſhes, which ſerve to balance the Body, and keep it up in the Water, and partly to facilitate the Fiſh's Aſcent to the top of the Water, to which he can immediately raiſe himſelf by a light Jerk of his Tail, thus placed, for the uſe of Reſpiration, which is neceſſary for him.

For doubtleſs, if violently detained under Water, he would in a ſhort time be ſuffocated or drowned. Immediately under the Skin lay the Fat, which as I remember, our Seamen call the *Blubber*; it was firm, full of *Fibres*, and in this ſmall Fiſh, of an Inch Thickneſs, encompaſſing and encloſing the whole Body, Back, Belly and Sides. The Uſe whereof I conceived to be, 1. To keep the cold Water at a Diſtance from the Blood, which is, I believe, actually and to the Touch Hot. 2. To keep in the hot Steams of the Blood from evaporating, by that Means alſo preſerving and maintaining its natural Heat; 3. Perhaps alſo, to lighten or counterpoiſe the Body of the *Fiſh*, which would otherwiſe be too heavy to move and ſwim in the Water. Under the *Blubber* lay the muſculous Fleſh like to that of *Quadrupeds*, but of a darker Colour.

The Body was divided into 3 *Regions*, or *Ventres*, like a *Quadruped*, *viz.* *Head*, *Breaſt* and *Belly*. The *Veſſels* and *Viſcera* in each *Venter*, for the main the ſame as in *Quadrupeds*; the *Abdomen* was encompaſſed about with a ſtrong *Peritonæum*; the *Guts* joyned to the *Meſentery*, and of a very great Length, by Meaſure 48 Foot, without any Difference or Diſtinction of great and ſmall, neither was there any *blind Gut*, or *Appendix*, that I could find; the Stomach was of a ſtrange Make, being divided into 2 large Bags, beſide other ſmaller ones; I found nothing in it, but a good Number of thoſe little long *Fiſhes*, which our *Fiſhermen* dig out of the *Sands* at *Low-water*, and therefore called in ſome Places *Sand-Eels*, by ſome they are called *Launces*, and by *Geſner*, *Ammodyta*. The *Liver* was of a moderate Size, ſituate in the Right-ſide, and divided into 2 *Lobes*, having no *Ciſtis Fellea*, or Receptacle of *Gall* annexed. The *Pancreas* large, ſticking cloſe to the 3d. Bag of the *Stomach*, into which alſo it's *Ductus* enters, and empties it ſelf. The *Spleen* was ſmall and roundiſh: The *Kidneys* large, ſticking cloſe to the *Back*, and lying contiguous one to the other; made up of many little *Kernels*, like to, but much leſſer than thoſe of an *Ox*, of a flat Figure, having no *Pelvis* in the Middle, but the *Ureters* going out at the lower End. The *Urine Bladder* was oblong, and little for the Bulk of the Animal, having on each ſide a *round Ligament*, made of the *umbilical Arteries* degenerating; The *Penis* long, ſlender, having a ſmall ſharp *Glans*; it appears not outwardly, but lies hid in its *Sheath* within the Body, doubled up, or rather reflected, in the Form of the Letter S. as is that of a Bull. The *Teſticles* lie within the *Cavity* of the *Abdomen* on each ſide, as they do in an *Hedge-hog*, and ſome other *Quadrupeds*, of an oblong Figure; for their internal *Subſtance*, *ſeminal Veſſels*, both *Præparantia* and *Deferentia*, *Epididymides*, *Vas Pyramidale*, *Corpus Varicoſum*, and *Glandula Proſtata*, exactly like to thoſe of *Quadrupeds*. The *ſeminal Veſſels* perforate the *Urethra* with many little Holes, whereof 4 are moſt conſpicuous, ſomewhat above the Neck of the *Bladder*.

It had ſix ſhort Ribs that had no *Cartilages*, and ſeven that had *Cartilages*, on each ſide I mean. The Breaſt-bone was very ſmall, the *Diaphragm* was Muſculous, as in *Quadrupeds*. The Heart large, included in a *Pericardium*, had its two *Ventricles*, its *Valvulæ Sigmoides Semilunares*, *Tricuſpides &* *Mitrales*, its *Coronary* Arteries and Veins; in a Word, the whole Structure and Subſtance of the Heart and Lungs agreed exactly with that of *Quadrupeds*. The *Wind-pipe* was very ſhort, as it muſt needs be, the Fiſh having no Neck, the *Larynx* at top was of a ſingular Figure, running out with a long Neck, and a Nob at the End like an old faſhioned *Ewer*.

The *Pipe* in the Head, through which this kind of Fiſh draw their Breath, and ſpout out Water, lies before the *Brain*, and ends outwardly in one common *Hole*, but inwardly it's divided by a *bony Sceptum*, as it were, into 2 *Noſtrils*; but below again it opens into the Mouth in one *Hole*. This lower Orifice is furniſhed with a ſtrong *Sphincter*, whereby it may be ſhut and opened at Pleaſure, and above this *Sphincter* the ſides of the *Pipe* are lined with a *glandulous Fleſh*, which if you preſs, you will ſee ſtart out of many little *Holes*, or *Papillæ*, into the Cavity of the *Pipe*, a certain *glutinous Liquor*. Above the *Noſtrils* is a ſtrong *Valve* or *Membrane*, like an *Epiglottis*, which ſerves to ſtop the Pipe, that no Water get in there againſt the *Fiſh*'s Will. Within the *Fiſtula* are 6 blind Holes, having no Outlet: 4 tending toward the *Snout*, 2 above the *Valve* that ſtops the *Noſtrils*, and 2 beneath it, and 2 tending towards the Brain, having a long but narrow Cavity for the uſe of ſmelling, as I conjecture, tho' opening the *Brain*, I could find neither *Olfactory Nerves*, nor *Proceſſus mammillares*.

The Eyes are ſmall conſidering the Bigneſs of the *Fiſh*, and ſituate at a good Diſtance from the *Baſis* of the *Brain*; the *Snout* is long, and furniſhed with very large *Muſcles* to root or turn up the *Sand* at the bottom of the Sea for to find Fiſhes, as appears in that we found nothing in his *Stomach* but Sand-Eels, which, as was intimated before, lie buried in the Sand. The *Brain* and *Cerebellum* are, for the Subſtance and *Anfractus* of them, the ſame with thoſe of *Quadrupeds*, only differing in the Figure, as being Shorter; but what they want in Length, they make up in Breadth. They have alſo the like *Teguments* called *Dura* and *Pia Mater*; ſix or ſeven pair of *Nerves*, beſides the *Optick*; the ſame *Ventricles*, only in the *Medulla oblongata* we obſerved not thoſe Protuberances called *Nates* and *Teſtes*. The *Skull* (*Cranium*) is not ſo ſtrong and thick as in *Quadrupeds*; but articulated after the ſame Manner to the firſt *Vertebra* of the Back-Bone This Largeneſs of the *Brain*, and Correſpondence of it to that of Man, argue this Creature to be of more than ordinary Wit and Capacity; and make to ſeem leſs fabulous and improbable thoſe ancient Stories related by *Herodotus*, *Pliny* the *Elder*, and *Pliny* the *Younger*.

In each Jaw it had 48 Teeth, ſtanding in a Row like to little blunt Pegs, the *Tongue* was flat, above an equal Breadth to the very tip, which was *Toothed* or *Pectinated* about the Edges, tyed firmly down to the bottom of the Mouth, all along the Middle, as *Ariſtotle* truly ſaith.

Whence I cannot but wonder that *Rondeletius* ſhould herein contradict *Ariſtotle*, and affirm, (contrary to *Truth*, as I believe) *quod Delphinis Lingua eſt mobilis, quæ modo exeri modo condi poteſt*; unleſs perchance in this Particular the *Dolphin* differs from the *Porpus*. For the *Porpus* is, as I take it, the *Phocæna* of the *Ancients*, which is a leſſer ſort of *Dolphin*, and not the *Delphinus*: at leaſt if the *Fiſh* we are deſcribing were a *Porpus*; for the *Teeth* of this Fiſh were leſſer than, and of a different Figure from thoſe in the Jaw of the *Dolphin* we got beyond Seas, yet is the Difference not great between the *Dolphin* and *Phocæna*. As for that *Fiſh*, which our *Seamen* now a days call the *Dolphin*, and which, as it is deſcribed by Mr. *Terry* and *Ligon*, hath *Teeth* on its *Tongue*, ſmall Scales, is Finn'd like a Rock, of a pleaſant Smell and Taſt, what it is I know not, but I am ſure it is *toto Genere* different from the *Dolphin* of the Ancients.

We obſerved not in this *Fiſh* any Noſtrils, beſide thoſe in the *Fiſtula*, nor any *Ear-holes* or *Meatus Auditorii* at all: wherein alſo *Ariſtotle* agreeth with us, which yet *Rondeletius* found out near the Eyes. But we obſerved in the Skull a *Bone*, anſwering to the *Os Petroſum*, which moſt certainly was the Uſe of *Hearing*.

As for the ſame *Porpus*, I agree with *Geſner*, that it was ſo called, *Quaſi Porcus Piſcis*, moſt Nations calling this Fiſh *Porcus marinus*, or the *Sea-ſwine*, Indeed it reſembles a *Swine* in many Particulars, as the Fat, the Strength of the *Snout*, *&c.*

A venomous ſcratch with the Tooth of a Porpus, by Dr. M. *Liſter*, n. 235 p 726.

LXXVII. *Forte ex Diſſectione Delphini*, ante Dies tres minimum mortui, admodum leviter Digitum vulneravi ab interna Parte; at citra Sanguinem ſcilicet ſimplici Dentis Raſura. Nihil autem Mali inde ſenſi ad Quartum uſque Diem; quo tempore cum quodam *Livore* Digitus paululum intumuit ad *Articulum*. Malum indies ſerpebat, adeo ut intra alios quatuor Digitos duos infeciſſet; tertiuſque tandem Digitus male ſe habuit. Plurima ex Concilio *Chirurgorum* adhibui, at parum profuerunt, jam Manus correpta eſt, Dolorque *Carpum* invaſit, ex hoc autem Fomento primum ſtetit. (R. *Aquæ Spermatis Ranarum* ℥vi. *Boli Armen.* ℥is. *f. Vitrioli Albi* ʒ *iiii. m.*) Calide bis quotidie admotum eſt. Item interdum alio modo (R. *Vitrioli Albi Combuſti, Boli Armeniac. an.* ʒ *iiii. Camph.* ℥*i. Aq. communis* lb. *viii. m. f. Collyrium.*) Deinde Nutrito impoſito & ſuperinjecto Emplaſtro ex Bolo & Diapalma, convalui ex hoc inuſitato ac improviſo Malo, præter *Livorem* autem, qui ſatis Venenum indicabat, Moleſtus ac Odioſus quidam Pruritus, an Igniculus dicam, me Dies, Noctesque vehementer angebat, *Cuticulam* Partium correptarum ex toto perdidi; Digiti autem ad Vires ſuas non niſi poſt aliquot Menſes reſtituti ſunt.

Poiſonous Fiſh about the Bahama Iſlands by M. J. L. n. 214. p. 312.

LXXVIII. The Fiſh that are here, (at *New-Providence* one of the *Bahama Iſlands*) are many of them poiſonous, bringing a great Pain on their Joynts, who eat them, which continues ſo for ſome ſhort time, and at laſt with two or three Days Itching the Pain is rubb'd off. Thoſe of the ſame *Species*, *Size*, *Shape*, *Colour* and *Taſte*, are one of them Poiſon, the other, not in the leaſt hurtful, and thoſe that are, are ſo only to ſome of the Company; the Diſtemper to Men never, that we hear of, proves mortal: Dogs and Cats ſometimes eat their laſt. In Men that have once had that Diſeaſe, upon the firſt eating of Fiſh; though it be thoſe that are wholſome, the Poiſonous Ferment in their Body is revived thereby, and their Pain increaſed.

Whales and Whale Fiſhing about Bermudas, by . . . n 1, p. 11.

LXXIX. 1. An underſtanding and hardy *Seaman* gives this *Account* of the *Whale-fiſhing* about the *Bermudas*; that tho' many Attempts of Maſtering the *Whales* of thoſe Seas had been unſucceſsfull, by reaſon of the *extraordinary Fierceneſs* and *Swiftneſs* of theſe monſtrous *Animals*, yet the *Enterprize* was lately renewed, and fit Perſons having been out at Sea 17 times, and faſtened their Weapons a Dozen of times, they kill'd in theſe *Expeditions*, 2 old *Female Whales*, and 3 *Cubs*, whereof one of the old ones, from the Head to the Extremity of the *Tail*, was 88 Foot in length, by Meaſure, its Tail being 23 Foot broad, the *ſwimming Fin* 26 Foot long, and the *Gills* 3 Foot long; having great Bends underneath from the *Noſe* to the *Navil*, upon her after-Part, a Fin on the Back, being within paved (this was the plain Seaman's Phraſe) with Fat like the *Cawl* of a *Hog*. The other old one, he ſaid, was ſome 60 foot long: Of the *Cubs*, one was 33. the other two, much about 25 or 26 Foot long. The Shape of the Fiſh, he ſaid, was very ſharp behind, like the Ridge of a Houſe; the Head pretty bluff, and full of Bumps on both ſides, the Back perfectly black, and the Belly white.

Their *Celerity* and *Force* he affirmed to be wonderful, in ſo much that one of theſe Creatures which he ſtruck himſelf, towed the Boat wherein he was, after him, for the ſpace of 6 or 7 Leagues in ¼ of an Hours time. Being wounded, he ſaith they make a hideous roaring, at which all of that kind that are within Hearing, come towards that Place where the Animal is, yet without ſtriking or doing any Harm to the wary. He is of Opinion, that this Fiſh comes neareſt to that ſort of *Whales* which they call the *Jubartes*, they are without *Teeth*, and longer than the *Greenland-Whales*, but not ſo thick. That they fed much upon Graſs, growing at the Bottom of the Sea, was ſeen by cutting up the great Bag or Maw, wherein he had found in one of them about 2 or 3 Hogſheads of a greeniſh graſſy Matter.

The largeſt ſort of theſe *Whales* might afford 7 or 8 *Tuns* of *Oyl* if well husbanded; the *Cubs* yield but little, and that is but a kind of Jelly. That which the old ones render, doth candy like *Pork's Greaſe*, yet burneth very well. He obſerved that the *Oyl* of the *Blubber* is as clear and fair as any *Whey*; but that which is boil'd out of the *Lean* interlarded, becomes as hard as *Tallow*, ſpattering in the Burning; and that which is made of the *Cawl* reſembleth *Hog's Greaſe*. He affirms that though this *Greaſe* be boyling, yet one may run ones Hand into it without ſcalding; to which he adds, that it hath a very healing Vertue for *Cuttings*, *Lameneſs*, &c. the Part affected being anointed therewith.

The time of *Catching* theſe *Fiſhes* is from the Beginning of *March* to the End of *May*, after which time they appear no more in that Part of the Sea, but retire, as it is thought, into the *Weed-beds* of the Gulf of *Florida*, it having been obſerved, that upon their *Fins* and *Tails* they have Store of *Clams* or *Barnacles*, upon which he ſaid, *Rock-weed* or *Sea-Tangle* did grow a Hand long; many of them have been taken off them, of the Bigneſs of great Oyſter Shells.

The ſame Perſon ſaith, that ſince his former account there hath been taken by order of the *Bermudas Company*, 16 of thoſe *Whales*, the *Oyl* whereof, to the Quantity of 50 or 60 *Tuns*, arrived in *Ireland* ſome few Months ago. n. 8. p. 132

He adds, that about 2 Years ſince, there ſtranded upon the Coaſt of *New-England*, a *dead Whale* of that ſort which they call *Trumpo*, having *Teeth* reſembling thoſe of a *Mill*, and its *Mouth* at a good diſtance from, and under the *Noſe* or *Trunk*, and ſeveral Boxes or Partitions in the *Noſe*, like thoſe of the *Tails* in *Lobſters*, and that being opened, there run out of it a thin Oiley Subſtance, which would candy in time, after which the Remainder being a thick fatty Subſtance, was taken out of the ſame Part with a Scoop. And this Subſtance he affirmed to be the *Sperma Ceti*; adding further, that the *Blubber*, as they call it, it ſelf, of the ſame ſort of *Whales*, when ſtewed, yields on the top a *Creamy Subſtance*, which taken off, and thrown upon *White-wine*, lets fall a dirty Heterogeneous Sediment, but what remains aloft, affords a *Sperma-Ceti like* Matter.

He concludes his Relation with obſerving, that theſe *Whales* were to be met with between the Coaſt of *New-England* and *New Netherland*, where they might be caught 8 or 9 Months in the Year; whereas thoſe about the *Bermudas* are to be found there only in the Months of *February*, *March*, and *April*.

By ,,, ib: p: 133. Concorning the *Death* of the *Whale*, which hath been related to have ſtranded upon *New England*, it is not very improbable but that it may have been killed by a certain *Horny Fiſh*, which is ſaid by Mr. *Terrey*, in his *Eaſt-India Voyage*, to run his Horn into the *Whale*'s Belly; and which is known ſometimes to run his Horn into Ships, perhaps taking them for *Whales*, and there ſnapping it aſunder, as happened not long ſince to an *Engliſh* Veſſel in the *Weſt Indian* Seas.

By Mr. Rich. Norwood, n. 30. p: 566. 3. Within theſe 2 or 3 Years, in the Spring-time, and fair Weather, they take ſometimes one, two or three *Whales* in a Day. They are leſs, I hear than thoſe in *Greenland*, but more quick and lively; ſo that if they be ſtruck in deep Water, they preſently make into the Deep with ſuch Violence, that the Boat is in Danger to be haled down after them, if they cut not the Rope in time; therefore they uſually ſtrike them in Shoal Water. They have here very good Boats for that Purpoſe, Mann'd with ſix Oars; ſuch as they can row forwards or backwards, as Occaſion requireth. They row up gently to the *Whale*, and ſo he will ſcarcely ſhun them; and when the *Harpineer*, ſtanding ready fitted ſees his Opportunity, he ſtrikes his *Harping Iron* into the *Whale* about or before the Fins, rather than toward the *Tail*. Now the *Harping Irons* are like thoſe which are uſual in *England* in ſtriking *Porpus*'s, but of ſingular good Metal, that will not break, but winde, as they ſay, about a Man's Hand. To the *Harping Iron* is made faſt a ſtrong Lythe Rope, and into the Socket of that *Iron* is put a Staff, which when the *Whale* is ſtruck comes out of the *Socket*, and ſo when the *Whale* is ſomething quiet, they hale him up by the Rope, and it may be, ſtrike into him another *Harping Iron*, or lance him with Lances in Staves till they have kill'd him. I do not hear that they have found any *Sperma Ceti* in any of theſe *Whales*; but I have heard from credible Perſons, that there is a kind of ſuch as have the *Sperma* at *Elutheria*, and others of the *Ba-*

bama

hama Iſlands (where alſo they find often Quantities of *Amber Greece*;) and that thoſe have great *Teeth* (which ours have not,) and are very *Sinewy*. One of this Iſland of *Bermudas* (*John Perinchief*) found one there Dead, driven upon an Iſland; and, though I think Ignorant in the Buſineſs, yet got a great Quantity of *Sperma Ceti* out of it. It ſeems they have not ſo much Oil as ours; but the Oil, I here, is at firſt, like *Sperma Ceti*, but they *Clariſie* it, I think, by the Fire.

By Mr. Rich. Stafford. n. 40. p. 793.

4. We have in theſe Seas about *Bermudus* great ſtore of *Whales*, which in *March*, *April* and *May*, uſe our Coaſt. I have my ſelf Killed many of them. Their Females have abundance of *Milk*, which their Young ones ſuck out of the *Teats*, that grow by their Navel. They have no *Teeth*, but feed on *Moſs*, growing on the Rocks at the *bottom* during theſe *three* Months, and at no other Seaſon of the Year. When that is conſumed and gone, the *Whales* go away alſo. Theſe we Kill for their Oil: But there have been *Sperma-Ceti-Whales* driven upon the Shore, which *Sperma* (as they call it) lies all over the Body of thoſe *Whales*. Theſe have diverſe *Teeth*, which may be about as big as a Man's Wriſt.

I have been at the *Bahama Iſlands*, and there have been found of the ſame ſort of *Whales Dead* on the Shore, with a *Sperma* all over their Bodies, but I could never hear of any of that ſort that were Killed by any Man, ſuch is their Fierceneſs and Swiftneſs. One ſuch *Whale* would be worth many Hundred Pounds. They are very ſtrong, and Inlaid with *Sinews* all over their Body, which may be drawn out *Thirty Fathom* long.

The uſe of Air Bladders *in* Fiſhes; *By* . . . n. 114. p. 320.

LXXX. 1. I conjecture that Fiſhes, by Reaſon of the Bladder of Air that is within them, can ſuſtain or keep themſelves in any Depth of *Water*; for the Air in that Bladder being more or leſs Compreſſed, according to the Depth the Fiſh ſwims at, takes up more or leſs ſpace; and conſequently the Body of the Fiſh, part of whoſe Bulk this Bladder is, is greater or leſs according to the ſeveral Depths, and yet retains the ſame Weight. Now the Rule *de Inſidentibus Humido*, is, that a Body that is Heavier than ſo much *Water* as is equal in Quantity to the Bulk of it, will Sink; a Body that is Lighter, will Swim; a Body of equal *Weight*, will reſt in any part of the *Water*. By this Rule if the Fiſh in the middle Region of the *Water*, be of equal *Weight* to the *Water* that is Commenſurate to the Bulk of it, the Fiſh will Reſt there without any Tendency *upwards* or *downwards*: And if the Fiſh be deeper in the *Water*, the Bulk of the Fiſh becoming leſs by the Compreſſion of the Bladder, and yet retaining the ſame *Weight*, it will *Sink*, and Reſt at the *Bottom*: And on the other ſide, if the Fiſh be higher than the middle Region, the Air dilating it ſelf, and the *bulk* of the Fiſh conſequently increaſing, but not the *Weight*, the Fiſh will riſe upwards, and reſt at the Top of the *Water*.

Perhaps the Fiſh by ſome Action can *Emit* Air out of his Bladder, and afterwards out of its Body, and alſo, when there is not enough, *Take in Air* and Convey it to this Bladder; and then it will not be Wondred, that there ſhould be always a fit Proportion of Air in the Bodies of all Fiſhes, to ſerve their uſe according to the Depth of *Water* they are Bred and Live in: Perhaps by ſome *Muſcle* the Fiſh can *Contract* this *Bladder* beyond the *Preſſure* of the *Weight* of *Water*. Perhaps the Fiſh can by its ſides, or ſome other Defence, keep off the *Preſſure* of the *Water*, and give the *Air* leave to dilate it ſelf. In theſe Caſes the Fiſh will be helped in all intermediate Diſtances, and may *riſe* or *ſink* from any Region of the *Water* without moving one Fin.

By Mr. Boyle ib. p. 311.

2. To determine whether a Fiſh doth *riſe* or *ſink* in *Water* by *Conſtricting* or *Expanding* himſelf, take a *Bolt-Head* with a Wide Neck, and having filled it almoſt full with *Water*, put into it ſome Live Fiſh of a convenient ſize; that is, the biggeſt that can be got in, as a *Roche*, *Perch*, or the like, and then draw out the *Neck* of the *Bolt-Head* as ſlender as you can, and fill that alſo with *Water*. Then obſerve the Motion of the Fiſh, and if upon his *ſinking* you perceive the *Water* at the ſlender Top does ſubſide, you may infer, he *Contracts* himſelf, and if upon his *riſing*, the *Water* be alſo *raiſed*, you may conclude, he *Dilates* himſelf.

by Mr. Ray. n. 115. p349

3. I think that ——— hath hit upon the true uſe of the *Swimming Bladders* of *Fiſhes*. For 1. It hath been obſerved, that if the *Swimming Bladder* of an Fiſh be *Pricked* or *Broken*, ſuch a Fiſh *ſinks* preſently to the *bottom*, and can neither ſupport nor raiſe up it ſelf in the *Water*. 2 Flat-fiſhes, as *Soles*, *Plaiſe*, *&c.* which lie always Groveling at the *bottom*, have no *Swimming Bladders* that I could ever find. 3. In moſt Fiſhes there is a manifeſt *Channel* leading from the *Gullet*, or upper Orifice of the *Stomach*, to the ſaid *Bladder*, which without doubt, ſerves for Conveying Air thereunto: But there is a *Valve* or ſome other Contrivance to hinder the *Egreſs* of it, ſo that you ſhall ſooner break the *Bladder* than force any Air out by this Channel. Yet in *Sturgeons*, Mr. *Willoughby* hath obſerved, that Preſſing the *Bladder*, the *Stomach* preſently ſwell'd: So that it ſeems in that Fiſh the Air paſſes freely both ways.

I verily think there is in the *Coat* of this *Bladder* a *Muſculous Power* to *Contract* it when the Fiſh Liſts: For, in many Fiſhes it is very Thick and *Opake*, like the *Coat* of an *Artery* (which hath, as Dr. *Willis* obſerves, ſuch a *Muſcular* Faculty) as for Example in all the *Cod kind*; in ſome, *v. g.* the *Hake*, call'd in Latin *Merlucius*, it is inwardly covered with a *Red Carneous* Subſtance, which I take to be *Muſculous* Fleſh; in others it is Forked at the Top, and to each Horn hath a Muſcle affixed. Now the *Muſculous* Force need not be great, being ſtill aſſiſted by the *Water*, as the Fiſh deſcends; the *Preſſure* of the *Water* being much greater at the *bottom* than at the Top.

The Power alſo of *Dilating* the *Abdomen* by the Muſcles aſſiſts thoſe Fiſhes to riſe, whoſe Natural Place is towards the *bottom*: And the Air Compreſſed in the *Bladder Dilating* it ſelf as the Fiſh Aſcends, Facilitates that Action of the *Muſcles*. But thoſe Fiſhes that deſcend by *Contracting* the *Bladder*, letting the *Contracting Muſcle* ceaſe to Act, will Riſe again of their own Accord, the Air within *Dilating* it ſelf; as we ſee in Glaſs Bubbles by *Compreſſion* of the Air in them Deſcending, which as ſoon as the Force is removed, Aſcend without more ado.

Beſides the Flat Fiſhes, I before mentioned, all the *Cartilaginious* Kind, as well Flat as Long, want *Swimming Bladders*: What Courſe they uſe to *Aſcend* and *Deſcend* in the *Water*, I know not. Many of the *Eel-kind* (not all) have *Swimming Bladders*, yet can they hardly raiſe themſelves in the *Water*, by reaſon of the length and Weight of their *Tails*: I ſuppoſe, the *Air Bladder* being near their Heads helps them to lift up their Head and Forepart.

The Eyes of Fiſh; *By Dr.* Allen Moulen n. 199. p. 716.

LXXXI. I have obſerved in the Eyes of Fiſh that the *Proceſſus Ciliaris* is not faſten'd to the joyning of the *Cornea* and *Sclerotis* as in all other Animals that I diſſected, ſo as to hinder the *Watery Humor* to go any further *backward*. For I conſtantly obſerved that the *Humor Aqueus* may move a good way *backward* in ſome, and in others almoſt as far as the *Optick Nerve*. And in as many Fiſh as I could conveniently examine carefully, I have found a *Membrane* which covered the *Tunica Cornea*, ſo as not to let any *Water* come to it. This anſwers the *Membrana Nictitans* in *Fowl*, and reaches on all ſides to the *Cutis* of the Fiſh to which it is faſtened. This is Tranſparent, and pretty Thin; and ſo is all the *Cornea*, if compared to that of *Quadrupeds*.

I have alſo obſerved that the Eyes of Fiſh, as well as thoſe of Fowl, are more or leſs *Cartilaginous*: For the *Sclerotis* is a *Cartilago ſui Generis*, eſpecially near the *Cornea*; and in the larger ſorts of them, I have found the whole *Sclerotis* ſuch a kind of a *Cartilage*.

The Structure *of the* Internal Parts *of* Fiſh; By Dr Char Preſton. n. 225. p. 499.

LXXXII. Fiſh are remarkably different from all other Animals in many particulars. The moſt conſiderable difference is their want of *Lungs*, and their not *Breathing*: And yet it is Neceſſary that ſomething ſhould ſupply this in Fiſhes, which may have the ſame Effect upon their Blood, as the Air has upon ours, by entering into our *Lungs*, that is to ſay, to Divide and Diſſolve it, and render it fit for *Circulation*. Now we find no part in Fiſh more proper to produce this Effect than the *Bronchia* that lie like ſo many Leaves upon each other under their *Gills*: For they receive the *Water* in by the Mouth, and return it by the *Gills*, or Receiving it in by the *Gills* they Throw it out by the *Mouth*. Hence it is agreed upon by all that the *Water* contains ſomething that Produces this Effect, and this ſeems moſt probably to be *Air*.

That there is *Air* in all *Water* cannot be doubted after this Experiment of M. *Marolle*. He ſet a Veſſel of *Water* over the *Fire*, ſo to drive out the *Air* from it. This *Water* he put into the *Air Pump* to draw out the *Air* from it; and after that fill'd a Vial with it, within 2 or 3 Fingers of the Top, which ſpace he left only full of *Air*, and ſtopt the Vial well; and by ſhaking it the *Water* imbibed the *Air*, ſo as to riſe up and quite fill the Vial.

But we need not wonder that Fiſh cannot alſo Live in the open *Air*. Their Blood is Naturally leſs *Hot* than ours, ſo that the natural *Heat* of ours would be a Fever in them, and Mortal: For the *Nitre* of the Pure *Air* is in too great a *Quantity*, and too ſubtile, ſo that it Diſſolves their Blood too much; and makes it too *Fluid*, whereas the *Nitre* in the *Water* is more Groſs and in leſſer Proportion; whence it gives their Blood only a *Fluidity* requiſite to keep it in its *Natural State*. To prove that it is in the *Bronchia* that this Diviſion is performed, we need but Obſerve their Extraordinary Redneſs above any other part of the Body; a Proof that the Blood is there more Divided. Fiſh are alſo found to die in *Water* frozen over, which happens plainly from their Communication with the *outward Air* being hindred by the *Ice*.

The *Heart* of Fiſh is Different from that of other *Animals* in its having but one *Ventricle*: For it has only the *Vena Cava* and the *Aorta* that open into it, having no *Lungs*. So that by the *Aorta* the Blood comes out of the *Heart*, which is Branched into a Thouſand *Capillaries* over the *Bronchia*, and is after Reunited; which Re-union is made under the *Baſis* of the *Cranium*; and becauſe the Blood, when once there, has no need of being forced higher upwards, they have no occaſion for a ſecond *Ventricle* for that purpoſe, as *Terreſtrial Animals* have. The Reunion of theſe *Capillaries* of the *Bronchia* being made, they form *two* large *Trunks*, of which one proceeds *towards* the *Head*, and the other *towards* the *lower Parts*.

Fiſh have a *Diaphragm*; but not for the ſame Purpoſe as in other *Animals* that Breath. It is always ſtrait and tenſe, and Perpendicular on the *Vertebra*; it hinders the *Terminating Salts* that Exhale from the *Inteſtines* from coming to the Heart, which might cauſe ſome Alteration there.

Their *Stomach* is *Membranous*; for Fiſh ſwallow down other ſmaller Fiſh whole, and ſometimes Earth. Wherefore 'tis needful to have a Power of Contracting and Straitning it ſelf, forceably to break to pieces the hard Matters contained therein. Their *Inteſtines* make ſeveral great *Windings* about; a Sign the *Fermentation* is but ſlow therein; which is made up by the length of the *Inteſtines*. The *Liver* has much the ſame Situation as in other Animals; as alſo the *Spleen* has. They are provided of a *Gall-Bladder*, a *Ductus Choledochus* and *Pancreas*, or rather two little Baggs faſtened to the *Ventricle* for the ſame uſe. Fiſh have uſually many *Pancreas*'s, ſo that in ſome there have been told 44. They have *Kidneys*, *Bladder*, *&c.*

They have the *Ovary* near the *Vertebra* of the *Loins*. The *Eggs* come forth at a Paſſage below the *Anus*: And the *Male* has a like *Ductus*, or *Hole*, by which they Eject their Seed upon that of the *Female* to impregnate the Eggs: which the Male ſometimes Changes the Colour of, as he paſſes over them, when he caſts his Seed upon them after they are Laid.

Fiſh have on the *Vertebra* of the *Loins* a *Bladder*, very large in Proportion to their Bulk; which ſerves, by *Compreſſing* or *Dilating* it ſelf, to render the Fiſh more or leſs heavy, as Occaſion requires. The *Fins* and *Tail* aſſiſt them in their Paſſage through the *Water* whither they will: But 'tis this *Dilatation* that makes them capable of *ſwimming* in it; and if this *Bladder* be by any means Burſt, ſo that it cannot be Extended, the Fiſh can no more raiſe it ſelf in the *Water*, but keeps continually at the *Bottom*. *Flat-fiſh*, ſuch as *Soles*, have none of this *Bladder*: For they are able, by Reaſon of their Breadth, to keep themſelves up in the Water. *Cray-fiſh*, and other *Shell-fiſh* want it likewiſe, for the moſt part; for they Creep only at the *Bottom* of the *Water*. There are many *Fiſh* that have them Double.

The Wild-Gooſe; By Dr. M. Liſter, n. 175. p. 1160.

LXXXIII. *Anſerum Ferorum Quinque* Genera vulgo numerantur in *Agro Eboracenſi* ſatis frequentium; *viz.* 1. *The little Spaniſh Gooſe*; *Sc.* æque Parvus ac *Brenta*; ſed Figura & Colore quodammodo ad *Anſerem Domeſticum* accedens; ab *Hiſpania* denominatur. 2. *The Barnacle* ſatis cognitus. 3. *The Scotch Gooſe*, *Sc.* Vulgatiſſimus Ferus, a *Scotia* ad nos, exeunte *Auguſto* adveniens, e quibus fere conſtant innumeri illi Greges qui in Planis Campis (*the Woolds* dictis) & alibi paſſim inveniuntur. 4. *The Whilk*, *Anſer Maximus Niger*, ineunte Bruma primum adveniens; raro alibi quam in Pratis, Paſcuiſque Herba paſcitur. 5. *Anſer Paluſtris* Noſter, *Grey Lagg* dictus; huic Magnitudo *Anſeri Domeſtico* ſubpar.

Caput ex *Fuſco Nigricat*, & ad Medium Collum *Infuſcatur*; Dorſum ex *Cinereo Liveſcit*, ipſæ autem Alæ, & earum Remiges *Nigricant*, uropygium *Albeſcit*, ejuſque Pennæ Externæ *Albida* ſunt; Venter *Cinereus*, is vero Imus ſenſim fit *Niveus*; Roſtrum a Capite ad Mediam fere partem *Nigrum*, deinde *Subpurpureum*, ipſo ejus Apice *Nigro*; in Superiore Mandibula non niſi unus *Denticulorum* Ordo, atque idem Simplex Ordo in inferiore: item huic Lingua utrinque Uno *Denticulorum* ordine Armatur. Pedes *Subpurpurei*, ſive *Carnei Coloris*; Ungues fere *Albidi*, excepto medii Digiti, qui ex majore parte *Nigricat*. Pendet *Libris* 7. & fere *Dimidium*. In Paludibus *Agri Eboracenſis* Nidificant; ipſi & eorum Pulli Menſe *Maio* pingueſcunt, & in Deliciis habentur.

Ib. p. 1161.

But I will not affirm the *Grey Lagg* to be different from the Common *Wild Gooſe*; Mr. *Ray*'s Deſcription and mine ſo well agree, ſave in the Colour of the *Bill* and *Leggs*.

The Barnacle, By Sir Rob. Murray. n. 137. p. 925.

LXXXIV. In the *Weſtern Iſlands* of *Scotland*, the Weſt Ocean throws upon their Shores great Quantities of very large Weather-beaten Timber; the moſt Ordinary Trees are *Firr* and *Aſh*. Being in the Iſland of *Eaſt*, I ſaw lying upon the Shore a cut of a large *Firr-Tree* of about 2½ foot Diameter, and 9 or 10 foot long, which had lain ſo long out of the *Water*, that it was very dry, and moſt of the Shells that had formerly covered it, were Worn or Rubbed off. Only on the Parts that lay next the Ground, there ſtill hung Multitudes of little Shells: They were of the Colour and Conſiſtence of *Muſcle Shells*. This *Barnacle-ſhell* is thin about the Edges, and about half as thick as broad. Every one of the *Shells* hath ſome Croſs Seams, or *Sutures*, which as I remember divide it into 5 parts, near about the manner as in the *Figure*. *Fig.* 236.

Theſe Parts are faſtened one to another, with ſuch a Film as *Muſcle Shells* are.

Theſe Shells hung at the Tree by a Neck longer than the Shell, of a kind of a *Filmy* Subſtance, round and hollow, and creaſed, not unlike the *Wind-Pipe* of a *Chicken*, ſpreading out broadeſt where it is faſtened to the Tree; from which it ſeems to draw and convey the matter which ſerves for the Growth and *Vegetation* of the Shell and the little Bird within it.

In every Shell that I open'd I found a Perfect *Sea-Fowl*; the little Bill like that of a *Gooſe*; the Eyes marked; the Head, Neck, Breaſt, Wings, Tail, and Feet, formed; the *Feathers* every where perfectly Shaped, and Blackiſh Coloured; and the *Feet* like thoſe of other *Water-Fowl*, to my beſt Remembrance. The biggeſt I found upon the Tree, was but about the Size of the *Figure*; nor did I ever ſee any of the little Birds alive, nor met with any Body that did; only ſome Credible Perſons have aſſured me that they have ſeen ſome as big as their *Fiſt*.

The Scotch Barnacle and French Macreuſe; By Dr Tancred Robinſon, n. 172. p. 1036.

LXXXV. 1. The *Bird* which at *Paris* is called *Macreuſe*, and in other parts of *France*, *Macroul*, the *French* Eat upon *Fiſh Days*, and all *Lent* thinking it to be a ſort of *Fiſh*, or a *Marine* Animal with *Cold Blood*, or elſe a *Barnacle* Generated either out of *Rotten* or *Corrupted Wood* floating upon the *Sea*; or out of certain *Fruits* falling into the Water, and there Metamorphoſed into a *Bird*; or elſe from a kind of Sea Shells, adhering to Old Planks and Ship Bottoms, called *Concha Anatifera*. But in truth theſe *Shells* contain a *Teſtaceous* Animal of their own Species, as the *Oyſter*, *Cockle*, and *Muſcle* do: Whereas the *Barnacle* is of the *Gooſe*, and the *Macreuſe* of the *Duck* kind, and both *Oviparous*; the Truth of which is Evident by the Anatomy of their Parts ſerving for *Generation*, and by their *Laying Eggs* and ſometimes *Breeding* among us.

The *Macreuſe* is the *Scoter*, or *Anas Niger Minor* deſcribed by Mr. *Ray*. It is frequently taken in Nets placed under *Water* upon the Coaſts of *Normandy* (moſt plentifully at the Mouth of the *Sein*) *Languedock* and *Provence*; and I am confident, I have ſeen it upon the *Laguna* of *Venice*, at the Mouths of the *Brenta*, *Addeſis*, and the *Po*. A *Duck* very like unto this (if not the ſame,) I alſo ſaw upon the *Mare Mortuum*, and the *Lake Avernus*.

The Macreuſe; By Mr. Ray. ib. p. 1041.

2. I had no ſooner ſeen the Caſes of the *Male* and *Female Macreuſe*, which Dr. *Robinſon* ſent me, but inſtantly I found it was no Stranger to me. There is a particular Deſcription of the *Cock* in Mr. *Willoughby*'s *Ornithology* among the *Sea Ducks*, to which this Bird belongs, and not to the *Divers* or *Duckers*. M. *Graindorge*'s Deſcription I find upon attent reading to be very Faithful: But notwithſtanding what he ſaith of the *Debility* of its *Feet*, unfit for Walking on Land, I ſee not but that it may March as well as the reſt of its Kind, all which have but Short and Weak Legs in Proportion to the bulk of their *Bodies*, and thoſe alſo ſituate very backwards.

What he ſaith of the Smallneſs and Weakneſs of the Wings, and Shortneſs of their *Feathers*, is common to many Sea-fowl, *viz.* the *Triudactyla* and *Mergi* which yet by the *Nimble* Agitation of them, fly very ſwiftly and ſtrongly.

Why they of the *Church* of *Rome* ſhould allow this *Bird* to be *Eaten* in *Lent*, and upon other *Faſting Days*, more than others of this Kind, but eſpecially the *Tridactyla*, I ſee no Reaſon, the *Fleſh* of theſe laſt, which Live only or chiefly by Preying upon *Fiſh properly ſo call'd*, taſting ſtronger of *Fiſh* then the *Duck kind*, which all feed, partly at leaſt, upon Shell-fiſh (as M. *Graindorge* found the *Macreuſe* alſo to do) and have a Delicate and well taſted *Fleſh*.

I obſerved in this *Bird*, and in ſome others of the Sea-Ducks that are much *under Water*, that they Want that *Veſſel*, or *Ampulla*, ſituate in the very Angle of the *Divarication* of the *Wind-Pipe*, which for want of a better and fitter Name we are wont to call the *Labyrinth* of the *Trachea*. We may very probably from hence Conclude, that the *Labyrinth* doth not ſerve them for a *Reſervatory* of *Air*, to enable them to continue the longer under *Water*, as I ſometimes conjectured, but for the intending and Modulating of the *Voice*, ſeeing in the *Plaſh-Duck* the *Females* want it: But I am ſomewhat to ſeek about the Uſe of this *Veſſel*. I Obſerved it in the *Mergus Cirratus longiroſter major* or the *Dun-Diver*, and that very large, and extended by very ſtrong *Bones*, and yet I thought my ſelf to have ſufficient reaſon to Judge that *Bird* to be the *Female* of the *Merganſer*: But I dare not be confident that it is the *Female* becauſe of this *Labyrinth*.

The Manner of Hatching Chickens at Cairo, By Mr. Jos Graves. n. 137. p. 923.

LXXXVI. In the Houſes built for this Uſe there is a long *Entrance a b.* on each ſide of which are 14 *Ovens* (ſome places have more, ſome leſs.) The *bottoms* and *ſides* of theſe *Ovens* which are on the Ground, are all made of Sun-dried *Bricks*, upon which they put *Matts*, and on the *Matts*, *Eggs*.

Fig. 237.

The top of theſe *Ovens* are flat, and covered with Sticks, except 2 long ſpaces which are made of Sun-dried *Bricks*; and are the *Hearths*, in which the Fires are made, to Heat the Eggs lying under them in the lower *Ovens*.

Above theſe lower *Ovens* are ſo many other, made of Sun-dried *Bricks*, and Arched at the top: Where alſo there are ſome Holes, which are ſtop'd with Tow, *&c.* or left open, as they pleaſe, to govern the Heat in the *Ovens* below. Theſe upper *Ovens* are made after this manner.

a. The *Mouth* of the *Oven*, opening upon the long *Entrance* above mentioned. *b.* and *c.* *Entrances* into the *Ovens* Adjoyning. *d. e.* two *Hearths* 3 or 4 *Inches* deep, in which they make the *Fire*, to Heat this and the *Oven* below. The depth of the lower *Oven* is about 2½ foot *Engliſh*: the Second above 4. *Fig.* 238.

They begin in the midſt of *January* to Heat the *Ovens*: Spending every Morning an 100 *Kintars* (or an 100 Pound Weight) of *Camels*, or of *Buffalo's Dung*, and the like Proportion at Night, till the midſt of *February* about which time the *Ovens* are ſo hot, that one cannot well endure to lay his Hand upon the Walls.

After this, they put the *Eggs* into the *Ovens* to *Hatch* the *Chickens*; which they continue Succeſſively till the End of *May*.

The *Eggs* are firſt put upon *Mats* in the lower *Ovens*, which are upon the Ground, 7 or 8000. *Eggs* in Number; and laid only Double one upon another.

In the *Ovens* above theſe lower, the Fire is made in the long or little Channels, from whence the Heat is conveyed into the lower *Ovens* before mentioned. The Eggs which are directly under theſe *Hearths*, lie Treble one upon another; the reſt, as was ſaid, only Double.

At Night, when they new make the Fires in the *Hearths* above-mentioned, they then remove the *Eggs* that were directly undermoſt (lying three one upon another) in the place of thoſe which lay on the Sides only double: and theſe being now removed, they lie Treble under the *Hearth*, becauſe the Heat is greater there than on the ſides.

Theſe *Eggs* continue in the lower *Ovens* 14 Days and Nights: Afterwards they Remove them into the upper *Ovens*; which are juſt over the lower. In theſe (there being now no more Fire uſed) they turn all the *Eggs* four times every 24 Hours.

The 21. or 22 Day the *Chickens* are *Hatched*; which the firſt Day Eat not; the Second, they are fetched away by Women, who give them *Corn*, *&c.*

The Maſter of the *Ovens* hath a 3d part of the *Eggs* for his coſt and Pains; out of which, he is to make ſuch good unto the Owners (who have *two* Thirds in *Chicken* for their Eggs) if any happen to be Spoiled or Miſcarry.

The Fire in the upper *Ovens*, when the *Eggs* are Placed in the lower, is thus proportioned.

The firſt Day the greateſt Fire, the Second leſs than the firſt, the Fourth more than the Third, the Fifth leſs, the Sixth more than the Fifth, the Seventh leſs, the Eighth more, the Ninth without Fire, the Tenth a little Fire in the Morning, the Eleventh they ſhut all the Holes with *Flax*, *&c.* making no more Fire; for if they ſhould the *Eggs* would break.

They take care, that the *Eggs* be no hotter than the Eye of a Man, when they are laid upon it, can well Endure.

When the *Chickens* are Hatched, they put them into the lower *Ovens*; which are Covered with *Mats*. Under the *Mats* is Bran to dry the *Chicken*: and upon the *Mats*, Straw, for the *Chicken* to ſtand upon.

To Breed *up* Pheaſants *and* Partridges; *Sir* Edm. King. n.23. p.428

LXXXVII. *Ants* are the Principal food of very young *Partridges* and *Pheaſants*, both Wild and Tamed, for ſeveral *Weeks*: And a chief Reaſon, why many find it ſo nice a thing to *Breed* up the ſaid *Birds* is, that either they give them too ſparingly of this food, or let them faſt too long; not knowing, that as ſoon as 'tis Day light, they will Seek it for their Breakfaſt, and if they want it, will in a few Hours be faint and weak, and ſome grow ſo Chill for Want of that Supply of Nouriſhment, that it is no eaſy Matter to recover them. But afterwards, when they are grown bigger, if by ill ordering of thoſe who ſhould keep them ſweet and often ſhift their Water, or by ill Dyet or muſty Corn, *&c.* they become ſick, then *Ants* will not always recover them, tho' you give them never ſo many; and I have been forced to make uſe of other Inſects to cure them, as *Millepedes* and *Earwigs*, either of which will do good, but both together better, given in a good Quantity, and at leaſt two or three times a Day. But then thoſe other things muſt be obſerved too, of keeping their Houſe clean, and giving them ſweet Corn and ſhifting their Water twice a Day, keeping them within till the Dew be from the Ground, letting them bask in the Sand, partly in the Sun, the Place being a little ſhaded, and putting them up in a warm Houſe before Sunſet.

LXXXVIII. 1. It is moſt certain that *Swallows* ſink themſelves towards Autumn into *Lakes*, no otherwiſe than *Frogs*; and many have aſſured me of it, who have ſeen them drawn up with a *Net*, together with Fiſhes, and put to the Fire, and thereby revived.

Swallows found in *Lakes* in *Winter*, by M. J. Schefferus, n. 19. p. 350.

2. I have frequently heard *Fiſhermen* affirm, that they have here, about *Dantzick*, often fiſhed them out of the Lakes in the *Winter*, but I never have ſeen it my ſelf.

By M. J. Hevelius, ib. p. 347.

LXXXIX. The *Ortygometra*, or *Rail*, is a ſort of Fowl very numerous in all Parts of *Ireland* in its Seaſon; but that's but ſhort, and laſts not above 3 or 4 Months in the *Summer*; during all the remaining Parts of the Year, it lies buried and aſleep under Ground.

The *Rail*, by *Dr.* Thom. Molineux, n. 234. p. 747.

XC. That ſort of Bird mentioned by Dr. *Plot* to be often heard in *Woodſtock Park*, (from the Noiſe it makes commonly call'd the *Wood Cracker*,) is perhaps the leſſer ſort of *Picus Martius Varius*: For ſince the Publiſhing of Mr. *Willoughby*'s *Ornithology*, I have obſerved that Bird ſitting on the top of an *Oaken Tree*, making with her Bill ſuch a Cracking or Snapping Noiſe, as we heard a long Way off; the ſeveral Snaps or Cracks ſucceeding one another with that Extraordinary Swiftneſs, that we could not but wonder at it. But how ſhe made the Noiſe, whether by the nimble Agitation of her Bill to and fro in a Rift of the Bough, or by the ſwift Striking of the *Mandibles* one againſt another, as the *Stork* doth, I could not clearly diſcern: But an intelligent Gentleman, who was very diligent in obſerving the ſame Bird, ſaid it was the former Way.

The Wood-Cracker, by Mr. *Ray*, n. 172. p. 1043.

XCI. Aviculam, quam a *Germanis Silk Tail* vulgo appellari audio, unam aut alteram Sclopeti glande transfixam, *Eboraci*, exeunte *Januario* 1680. vidi. Sane perquam elegans Avicula eſt; Magnitudine *Turdum* fere æquabat; huic in extremis alarum Pennis 4 aut 5 Apices Parvi *Coccinei* Nudi, Cornei, minime

The *Silk Tail*, by Dr. M. Liſter, n. 175. p. 1161.

minime Plumis Veſtiti; item in extrema Caudâ Limbus, Latus, *Luteus*, inſtar *Corticis Citri*, cætera maximam partem *Lanium* Colore refert.

But I have ſince view'd the *Bill* of this kind of *Bird* at Mr. *Charlton*'s, and find it to want the Notches in the upper Part of the Bill proper to the *Lanius Kind*, it muſt therefore be put among the *Jays*.

The humming Bird, by Mr. Jo. Winthrop, n. 74. p. 2223.

XCII. 1. I have ſent you the curiouſly contrived *Neſt* of a *Humming Bird* ſo called from the *humming Noiſe* it maketh whilſt it flies, 'Tis an exceeding little Bird, and only ſeen in Summer, and moſtly in Gardens, flying from Flower to Flower, ſucking *Honey* out of the Flowers as a *Bee* doth; as it flieth, not lighting on the Flower, but hovering over it, ſucking with its long Bill a ſweet Subſtance. There are in the Neſt 2 of that Bird's Eggs, whether they uſe to have more at once I know not.

By Mr. Oldenburg, ib.

2. Theſe Eggs were ſo ſmall, that being weighed by me, the one weighed but about 5 Grains, the other 3½: And the Whole Neſt weighed no more than 24 Grains.

By Mr: Hamerſly, n. 200. p: 760. n: 202. p: 825.

3. There is in moſt parts of *America* a *Bird* call'd by the *Engliſh* the *Hum-Bird*, by the *Spaniards Tomincius*. He is of a moſt excellent ſhining Green Colour, and very reſplendent; the Colour doth ſomething reſemble ſome of our *Engliſh Drake's Heads*. It doth inhabit in ſome of the colder Parts of *America*, as well as in the hotter. It is the leaſt of all Birds that I have ſeen there or in *England*, her Leg and Foot together is but half an *Inch*, the other Parts anſwerable; the Trunk of her Body not an Inch. I did weigh one in thoſe Parts as ſoon as ever it was killed, whoſe Weight was the 10th part of an Ounce *Avoirdupois*, which I take to be about the *Weight* of a *coined Sixpence*: And I have weighed here in *England* a *Tit Mouſe*, (which I take to be the leaſt *Bird* here) and it weighed above *two Shillings*, and ſome half a Crown. I ſaw one of their Neſts made of *Cotton Wool*, in form and bigneſs of the *Thumb* of a Man's *Glove*, with the taper End ſet downwards, wherein were 2 Eggs of the bigneſs of a *Pea*, of Oval form. They feed by thruſting their *Bill* and *Tongue* into the *Bloſſoms* of *Trees*, and ſo ſuck the ſweet Juice of *Honey* from them; and when he ſucks he ſits not, but bears up his Body with a hovering Motion of his *Wings*; but for the Relation that he is a curious *Singing Bird*, I think it untrue. An *Indian Soggamore* is not in his full Pomp and Bravery without one of theſe Birds in his Ear for a *Pendant*. He is called the *Hum Bird* or *Humming Bird*, becauſe ſome ſay he makes a Noiſe like a *Spinning Wheel* when he flies: But I have been many times very near them, both when they hovered, and when they did fly, and I never heard any Noiſe; beſides, their *Body* and *Wings* are too ſmall to ſtrike Air enough to make any Noiſe. But of this I ſhall not be poſitive, becauſe ſome *Authors* are oppoſite to me. It is a ſolitary Bird, I never ſaw but 2 at a time together, *viz.* the *Male* and *Female*; they being eaſily known when together, the *Male* being ſomewhat bigger than the *Female*.

If one take a *Smallbirds Wing*, and ſtand 4 or 5 Yds. from a *Candle* (when dark) and open the *Wing*, and look thro' it at the *Candle*, he may ſee a moſt elegant *Colour* of *Red* and *Green*, which *Green* doth ſomething reſemble the Colour of this Bird.

4. Perhaps the *Tomincius* does not feed on any Juice he ſucks off, or out of Flowers, but rather (like many other Birds) on ſmall Inſects, ſome whereof lie in the *Bottom* of moſt Flowers; and for which this Bird hath a Bill, whereas a Bird that ſucks hath a *Syphon* or hollow Probe.

By Dr. Neh. Grew, n. 205 p. 815.

XCIII. There is a very great variety of Species in the *Parrot kind*, whether we conſider the *Country*, *Size* or *Colour*; *Johnſton* ſays, the curious have obſerved above an hundred ſorts of 'em. The *ſixth ſpecies* of *Parequets*, by *Margravius*, comes very near our Subject.

Obſervations on the diſſection of a Paroquet, by *Mr. R. Waller.* n. 111. p 153. Hiſtory of Braſile.

Its ſize is between a *Sparrow* and a *Black-bird*, with a *ſhort Neck*, black Eyes, a crooked ſcarlet Bill, greyiſh Legs and Feet, with Toes two before and two behind, like the *Parrot*; yet he never ſtands on one Foot to *Eat* with the other, as *Parrots* do. When he ſtands ſtill on the Perch, his Breaſt and Belly ſhew of a curious light green, his Back, and the Feathers of his Wings are ſomewhat darker; on his Pinions are ſome ſhort blue *Feathers*, as likewiſe a *pretty* many on his Rump. His *Bill* is encompaſſed up to the *Eyes* with a broad beautiful *ſcarlet* Circle, reaching alſo down to his *Throat*. This Place in the *Hen* is of a paler *Orange Colour*, wherein is the only obſervable Difference. The *Feathers* of the *Tail* (which in all ſmall *Parequets* is no longer than the Wings) are not to be ſeen but when he *flutters* or *ſpreads* it. They are about *two Inches* long, near the Quill of a *Limon-Colour*, enclining to a *Green*; next that a *Scarlet* for a pretty Breadth; then a narrow Thread of *Green* on ſome of them, after that a Black; and laſt of all ending in a light Green.

Having opened the *Thorax* and *Abdomen* (if I may ſo call them,) by blowing into the *Aſpera Arteria*, a large Cavity or Bladder was raiſed up all along the *Abdomen* to the *Edges* of the *Os Iſchion*, and faſten'd to the *Gizzard*, containing in it all the *Guts* and *Gizzard*, but excluding the *Heart* and *Liver*. A Confirmation like this is obſerved in all *Birds*, and peculiar to them, and mentioned by M. *Perault*, the *Air* received by the *Lungs*, refreſhing and carrying off the noxious Steams from the *Entrails*, is not confined, as in *Men*, and *Quadrupeds* to the *Thorax* only, by a *Mediaſtinum*.

Mech. des Animaux.

The *Aſpera Arteria* differs from that of moſt other *Animals*, having not only a *Larynx* at the top thereof, as is uſual, but another alſo at its *Entrance* into the *Breaſt*, where it is divided, and *Branches* it ſelf into two. From this Structure, as I have been told, common to all *Parrots*, poſſibly it may be, that they can ſo readily imitate human Voices; but this Creature we Diſſected, never attempts an Imitation of Words, making only a ſhrill chirping Noiſe, doubling the Tone, or making it 8 Notes lower, as a ſtopt *Organ-Pipe* is an Eighth to the ſame Open. This lower *Larynx* may aſſiſt the Weak Fabrick of ſo ſmall a Creature as a *Parrot*, to counterfeit ſo Baſs a Voice as a Man's; it being obſerved by ſome ingenious Perſons, that *Parrots* are *Ventriloqui*; and that it may be Queried, whether all Ventriloquous Cheats may not by Nature be framed for ſuch an Impoſture.

The Heart in Proportion to the Animal, was large, and the Liver ſmall.

The *Tongue* was broad and thick, at the End ſomewhat like a Man's; whence a *Parrot* has its Name ἀνθρωπόγλωττος: the extremity of it was armed with a black Horny Cover.

It has, beſides the *Gizzard*, 2 *Craws*, the uppermoſt *Craw* being only a Receptacle or Sack for the Food (which is *Canary-ſeed*) to be again committed to the Mouth of this Bird, where it is again chewed, having before been only husked; this Animal ruminating as ſome *Quadrupeds* do; and I have obſerved this Bird, when upon the *Perch*, not only bring its Food again up into its Mouth, and there chew it, but when the *Cock* and *Hen* ſit together on the *Perch*, he will put out of his into the *Hen's* Mouth. Their Manner of chewing is thus, the under Bill being much ſhorter, ſhuts within the upper, or againſt the Roof of the *Mouth*, which is fitted with ſeveral rows of very ſmall and ſcarce to be ſeen *Croſs-bars*, as the Mouths of *Horſes*, *Dogs*, and ſome other Animals are; theſe *Bars* are not ſoft, but horny, as being part of the upper Bill, ſo that the *Bird* by carrying the Edge of the under *Bill* and End of the *Tongue* againſt the *Ridges* in the upper, breaks and reduces to a Pap the Seeds that have been firſt moiſtened in the *Craw*, to expedite which Action, the upper *Bill* is jointed juſt below the Eyes. The Food being thus macerated, is by the *Gula* again committed to the ſecond Craw; but before its Entrance into it, it paſſes by an Abundance of ſmall *Glands*, placed in that part of the *Gula*, that the Food may ſqueeze out of them in its Paſſage a Juice; of what Neceſſity in Digeſtion may be enquired. From hence the Food paſſes into the *Gizzard*, or proper *Ventricle*, ſmall in Compariſon of the *Ingluvies* or *Crop*; where, by ſeveral ſmall Stones pickt out of the Sand given it, by the Motion of the *Gizzard*, it is comminuted, and thence tranſmitted to the Inteſtines, on the Sides of which, within a ſmall Diſtance is placed the *Pancreas*.

The Explication of the Figures, *Fig.* 240. *a*. The *Aſpera Arteria*. *b*. that part which forms, as it were, another *Larynx*. *c*. Part of the *Gula*. *d*. the upper *Craw*. *e*. the Heart. *ff*. the *Venæ axillares*. *gg*. the *Jugulars*. *h*. a ſmall *Gland* on one of them. *ii*. the 2 *Auricles* of the *Heart*. *kk*. the *Liver*. *l*. the *Gizzard*.

Fig. 241. *a*. The *Trachea*. *b b*. the *Larynx*; by which *Parrots* are rendred *Ventriloqui*. *c c*. the 2 Branches of the *Trachea*.

Fig. 242. *a a*. The *Cornua* of the *Os Hyoides*. *b b*. two Muſcles of the *Larynx*. *c*. the Fiſſure, or *Glottis*. *d*. the *Trachea*. *e*. the *Tongue*. *f*. the *Horny End* thereof,

Fig. 243. *a a*. The *Teſtes*. *b b*. the *Deferentia*. *c c*. the *Kidneys*. *d d*. the *Ureters*.

Fig 244. *a* The Upper Part of the *Gula*. *b*. the firſt or upper Craw. *c*. that Part of the *Gula*, whoſe Inſide is Glandulous. *d*. the lower *Craw*. *e*. the *Gizzard*, or *Ventricle*. *f*. the firſt *Inteſtine*. *gg*. the *Pancreas*.

Fig. 245. *a*. The upper *Bill*, *b*. the Inſide of it. *d d*. the upper Jaw. *c*. the Place where the upper Bill is moveable. *e*. A Paſſage to the Noſtrils. *f*. the

Lower Bill. *g*. the upper Bill in another Poſture, to ſhew the ſmall Ridges therein.

XIV. The *Oſtridge* is eſteemed the largeſt and talleſt of winged or Feathered Fowl, as being ſometimes 8 foot high: Which Bulk, if we compare with the *Tominejo*, or *Humbird*, weighing about 12 Grains, we may readily diſcern within what Compaſs and Latitude the Creation of Birds was ordained.

Obſervations on the Diſſection of a Oſtridge, by Dr. Edw. Brown, Ph: Coll. n. 5. p. 147.

The whole Foot of this Bird, *a Calcaneo ad extremum Digitum*, is $\frac{3}{4}$ of a *Yard*; upon which he ſits when he reſts himſelf; But the Foot properly ſo called, or longeſt Claw is only $\frac{1}{4}$; the leſſer Claw $\frac{1}{8}$ and half a Nail. The Nail upon the longer Claw is a Nail long: above which ſtands one above another 63 large Scales, reaching up along his foot before, or before thoſe Bones which anſwer to the *Metatarſus*. The leſſer Claw hath no Nail, and only 8 or 9 Scales one above another, which reach no higher than the Claw it ſelf. The Grain of the Foot is like the Grain of the Skin of an Elephant, but not ſo very hard, and is moveable, and gives way upon Preſſure like the Foot of a Camel; there being fat under it, whereby he treads ſoft, and without Noiſe: But higher than the two Claws the Skin looks ſcaly. Every ſmall Scale conſtituting an irregular *Pentangle*, *Quadrangle*, and ſometimes *Hexangle*.

From the Heel to the Knee, or that Part of the Leg which anſwers to the *Tibia* in Man, it is $\frac{1}{3}$ of a Yard. The Thigh above $\frac{1}{4}$ and very thick.

Upon the *Breaſt* there is a [illegible]d callous dark Subſtance, of an oval Figure, a Nail and a half in Length, like to that of a *Camel*, upon which he reſts himſelf when he ſits, with his Head upright; and in that Poſture I think he ſleeps, for we could never ſee him in any other. His *Wing* is too little to cover all his Neck. There is alſo a callous Part upon the *Os Pubis*, longer than the former mentioned, but narrow; upon which, together with the callous Part upon his Breaſt, he reſts himſelf. The Length of his Body from the lower Part of the Neck to the End of the Rump, is one Yard; the longeſt Bone in his Wing is $\frac{3}{8}$ of a Yard, and his Neck a Yard, not meaſuring the Head with it.

The top of the Head is flat, in length ’ of a Yard, meaſuring from behind the Head to the End of the Bill. It ſeems to be hairy rather than covered with Feathers, but the Neck hath beautiful white Feathers, contrary to what ſome affirm. On the top of his Head there is a flat Oval Place, a Nail in Length, which is all callous, and without any Hair, or Feathers, like the callous Part of his Breaſt, but not ſo thick, to preſerve the Brain from the *Serenes* that fall in hot Countries, and other Injuries of the Air, eſpecially in the Night, and the more conſiderably, if he ſleeps with his Head upright, and not under his Wing.

The *Gula* is very large, as well as long, but largeſt at the top near the Head: where it is a Nail and a half broad. The *Os Hyoides* ſtretcheth it ſelf down on each ſide of the Neck, the Length of $\frac{1}{4}$ of a Yard and half a Nail.

Beſides the many *Muſcles* in the Neck, for the Motion of the numerous *Vertebræ* and the *Head*, there are two moſt elegant Muſcles, which come from within the *Thorax*, ariſing within the Cheſt about the 2*d*. Rib, which inſert themſelves on each ſide of the *Aſpera Arteria*; theſe I may name *Directores Aſperæ Arteriæ*. At the firſt dividing of the *Aſpera Arteria*, or its Divarication on each ſide of the *Lungs*, there is a Ring bigger and ſtronger than any other Ring of the *Wind-pipe*. There are divers *Glandules* in the Neck near the *Gula*, theſe are of a pale Colour like Aſhes, but there are two moſt beautiful *Glandules* ſticking to the *Carotidal Arteries*, as they come out of the Breaſt, one on each ſide, theſe are blueiſh.

The *Peritonæum* doubles and encompaſſes the *Stomach* looſely. He hath 7 Ribs, and the *Intercoſtal Muſcles* are broad, plain, and beautiful. He hath no Prominent Breaſt-bone, like other Fowls, nor a narrow Cheſt like many *Quadrupeds*, but a broad Breaſt, and a large firm *Sternon*, of the Shape of a Shield, broader than the *Sternon* of a Man; and indeed when he puts down his Head, and bends his Neck round to come in at a Door, his Breaſt is ſo broad, and his Tread ſo different, that it is not at all like the Entrance of a Fowl, but wonderfully like that of a *Camel*, but with this Advantage, that the *Oſtridge* bearing his Weight upon two Legs only, his Entrance is more bold and graceful.

The *Penis* was about an Inch long, with a ſmall cartilaginous Subſtance in it; the *Teſtes* lie very high, near the Kid[illegible]s and Back-bone, and were very ſmall and ſlender, of a yellow Colour.

The Ear is round, and the Orifice will receive ones Finger; the Eye is large and blueiſh, and almoſt as big as a Man's.

The natural Colours of the Feathers of this Fowl were White, Grey and Dun; the Feathers of the inſide of the Wings, upon Breaſt, and Belly, and Neck, were white, and the Feathers in the Tail alſo white, but the reſt are greyiſh, or of a Dun Colour, yet it is a moſt beautiful Creature ſurely in *Barbary*, w[illegible]he Heat of the Country criſps and curls all its *Feathers*.

The *Rimula* of the *Larynx* is long, and the Cartilages about it ſtrong, but no *Epiglottis*, or Likeneſs to a Human *Larynx*, although they that heard its Voice, compare it to the Crying or Shrieking of a hoarſe Child, but more mournful and diſmal. The *Lungs* are of fine florid Colours, but little in Proportion to the vaſt *Aſpera Arteria*, they ſtick cloſe to the Back, and are perforated like other Birds: And upon blowing into the *Wind-pip* with a Pair of Bellows, we could not make them riſe or fill. The Heart hath two Ventricles, about the Bigneſs of a Man's Heart, but the right Ventricle is much thinner, and the Valves are more fleſhy.

There are two *Stomachs*, as in Granivorous *Fowls*, a *Crop* and a *Gizza* but the Crop, or firſt Stomach, differs much from that of other *Fowls*, i that it is not placed without the *Breaſt* but within the *Sternon*, in that it is not round but longer like a Bag, and of a vaſt Bigneſs, lying lengthwiſe in the Body. We found many *Glandules* in the Coats of this *Stomach*, a row of them on the back part of it, reaching almoſt from one End to the other, about a *thouſand* of them, about *ten* in *Breadth*, and an *hundred* in Length. Theſe lie between the Coats of the *Stomach*, and every particular Glandule diſcharges it ſelf by a peculiar Orifice, thro' the inward Coat of the Stomach into the Cavity thereof. We found ſome of theſe *Glandules* round and globular, ſome oval, and ſome more flat, and of an irregular Figure; thoſe which lie higheſt are roundeſt and thickeſt, thoſe which lie more towards the Bottom of the *Stomach*, or where it unites with the *Gizzard*, are more broad and flat. Theſe bring in a Juice which helps to digeſt that various Nouriſhment which this Fowl makes uſe of. The *Gizzard* was very large, the inner Coat did not adhere ſo firmly as in other *Fowls*, and was very thick and like *Flannel*, and upon our firſt looking into the *Gizzard*, from the firſt Stomach it appeared as a Piece of *Flannel* or *Napkin*, which the *Oſtridge* had ſwallowed, and ſo ſtuck there. The Paſſage out of the *Gizzard* into the ſmall Guts is very ſtreight.

The *Guts* are about 20. Yards in length, the ſmaller Guts beginning from the *Stomach* are ten Yards long; and the larger Guts down from thence to the *Anus*, are near as much. At the Beginning of the great Guts there are two *Inteſtina Cæca*, each of them a Yard long: And they have a Scrue or *Spiral Valve* within them, after the Manner of the *Cæcum* of a *Rabbet*, this Scrue in both the *Inteſtina* winds about 20 Turns. The Extremity of the *Cæcum* is little, not much differing from the *Cæcum* of a Man. The Excrement, which is thrown out by the Guts, is of two Kinds, a White, thin, ſticking Excrement, which it mutes like a *Hawk*, and after that, another ſort of Excrement comes, which is very like to that of a Sheep, but bigger.

The *Meſentery* although it holds together ſuch a Number of Guts, great and ſmall, yet it is not thick, but is only a tranſparent *Membrane*, as generally in *Pennates*; but it is very large, and in ſome Places above ¼ of a Yard deep or broad, meaſuring from the Center to the *Guts*.

The *Liver* hath 4 *Lobes*, and is of a Colour not much different from that of a *Man*'s, we could find no Bladder of *Gall*. There was a *Glandule* under he *Stomach*, which might ſeem to be a *Spleen*: But *Pennata* and *Inſecta* are ſaid aid to have no *Spleens*. The *Pancreas* was ſlender, and above a foot long. The Kidneys are large, and of the length of my Hand, as they lie both together, they are of the Shape of a *Guitar*. The *Ureters* are firm, ſtrong, hite and long. Behind the Kidneys lie two *Glandules* ſomewhat oval, of bout an Inch and half in length, cloſe to the Back-bone.

The Head reſembles that of a *Gooſe*, and is little in Proportion to the hole Body.

In *Africa*, where ſome make Meat of *Elephants*, it is no Wonder if ſome ſo feed upon *Oſtridges*; but *Galen* and *Phyſicians* condemn it as hard of igeſtion.

The Cuntur of Peru, by Dr. H. Sloan, n. 208. p. 61.

XCV. The *Magnitude* aſcribed to the *Cuntur* or *Condor* of *Peru*, as well as its great Force and Strength, have been the Cauſe that many have doubted its Being. Capt *John Strong*, Commander of a Ship which went into the *South-ſeas*, through the Streights of *Magellan*, and returned after 23 *Months* Voyage. in the Year 1691. give me this Account, together with a Wing or Quill-feather of the Bird, *viz.* That on the Coaſt of *Chili*, they had met with this Bird in about 33° *S. Lat.* not far from *Mocha*, an Iſland in the *South-ſeas*, and before they came at a Place called *Herradura*, that his Men were very much amaz'd at the Bigneſs of it, and that after they had killed it, it was 16 Foot from Wing to Wing extended. The *Spaniſh* Inhabitants there told them, it was the Cuntur, and that they were afraid of theſe Birds, leſt they ſhould prey on, or injure their Children. The Feather he gave me, is 2 foot 4 Inches long, the Quill-part is 5 *Inches* ¼ long, and an *Inch* and *half* about in the largeſt Part, it weighed 3 *Drams* 17 *Grain* and *half*, and was of a dark brown Colour, very hollow or concave on one Side, and convex on the other. The *Seamen* ſhot it ſitting on a Cliff by the Sea-ſide, and Eat it, taking it for a ſort of *Turkey*, in which Miſtake likewiſe, the firſt Comers to *Jamaica* were with a Bird in that Place, called a *Carrion-crow*, which is a ſort of *Vulture*, of which kind, I believe this alſo is.

Obſervations on the heads of Fowl, by Dr. Allmoulen, n. 199. p. 711.

XCVI. 1. In the Heads of all Fowl that I have had an Opportunity to Examine, I conſtantly found only one *Aquaductus*, or Paſſage from the Ears into the Pallat; whereas in Men, Quadrupeds, and ſome Amphibious Fiſh, there are always two. This Paſſage in *Fowl* is exactly in the middle of the Pallat, below the Entrance of the Noſtrils into it. It is a Membranous *Tube*, capable of admitting a *Raven*'s, if not a *Gooſe* Quill in Larger Fowl, ſuch as *Turkeys*, *Geeſe*, &c. and reaches backwards as far as the Communication from Ear to Ear: And hence it comes to ſerve both; whereas there is a Neceſſity of two in thoſe Animals, whoſe Ears do not communicate.

2. I conſtantly found a hollow ſpace between the 2 *Tables*, between the *Os cuneiforme* reaching from *Ear* to *Ear*, and as far forward as the aforeſaid common *Aquaductus*, or rather *Ductus Aereus*, the Contrivance of it ſeeming more to favour this than the former uſe. This Cavity in all Fowl (as far as I have obſerved, reaches above the *Labyrinthus* on each ſide; ſo that whatever Impulſe is made on the *Tympanum* on the one ſide, may not only be very readily communicated by Means of the internal Air to the *Labyrinthus* of the ſame, but alſo to that of the oppoſite Side. Hence probably proceeds the Quickneſs of Hearing and Vigilancy of Fowl, notwithſtanding their wanting a Cochlea: the Defect of which ſeems to be by this Structure more than ſupplied, no other Creatures that we know of having any thing of it. There are ſeveral *Laminula* and Pillars of Hard Bone between the 2 Tables in theſe Cavities, deſigned, as may be ſuppoſed,

partly for their Maintenance at a convenient diſtance, and partly for breaking of the *Air*, ſo as to hinder *Echoes*, and confuſed Repreſentations of Objects, as it hath been ingeniouſly obſerved by Sir *J. Hoskins*, That Pillars in Churches very much prevent *Echoes*.

3. In the Heads of *Woodcocks*, beſide the Paſſages now deſcribed, I found one on each ſide the Bone, making the Orbit of the Eye, proceeding from the Ear, and reaching forwards towards the ſetting on of the *Beak*, near which they joined in one, and turned under the Skull in a ſmall Paſſage leading to the Cavity, by which the *Ears* communicate, and which is above deſcribed, into which it enters. Theſe Paſſages are alſo in the Heads of *Snites*, and moreover one over the *Sinus Longitudinalis*, and another over the *Sinus lateralis* of the Brain. *Note*, that in the killing of Snites, and ſmaller Birds, if Care be not taken that the *Head* be not bruiſed, theſe Paſſages cannot be diſcovered for Blood extravaſated in them. *Note* alſo, that the *Laminulæ* and Bony Pillars are every where to be obſerved where there is a Paſſage, excepting under the Skull, in the Paſſage from the ſetting on of the Bill to the firſt Paſſage deſcribed.

4. In the *Heads* of *Parrots* and *Paroquets*, beſides the firſt deſcrib'd Paſſage, I obſerved, between the two Tables, every where Cells opening into others, and thoſe into others, ſo that there was not any Part ſcarcely of the Skull that was not taken up with them. And this did not only appear by pouring into one Ear, freed from its *Drum*, the other alſo being removed, a *Tincture* of *Coobineel* and then blowing of it into all theſe Cells, ſo that no Part was free from *Tincture*, but it appeared alſo to the naked Eye, notwithſtanding that ſometimes it was difficult to trace the Communications of them, by Reaſon of the Numerouſneſs of the *Laminulæ* and Pillars aforeſaid.

5. In *Singing-Birds*, the Structure of theſe Paſſages is like that of the Parrot and Paroquet, only that the Pillars and Laminulæ are leſs than they ſhould ſeem to be in Proportion to the Heads: from whence it is probable, that theſe Birds are by this Structure enabled to diſtinguiſh Sounds and Notes, and alſo imitate them better, having a more muſical Ear.

6 In the Heads of *Pullets*, *Geeſe* and *Ducks*, I found only the firſt deſcribed Paſſage diſtinctly: But in *Plovers*, *Buſtards*, and ſome other, I found another that went over the *Sinus Lateralis* of the Brain from *Ear* to *Ear*. This ſeems to be deſigned to make them more watchful than domeſtick *Fowls*, or than thoſe that live much on the Water, becauſe they are liable to a great many Dangers that the others are exempt from.

7. In the Ears of all the fowl that I could examine, I never found any more than one Bone and a Cartilage, making a Joint with it, that was eaſily moveable.

The Cartilage had generally an *Epiphyſe* or two on each ſide, which were very flexible, as it ſelf was. The Bone was ſmall and very hard, having at the End of it a broad Plate, of the ſame Subſtance, very thin; upon which it reſted as on its *Baſis*.

8. I obſerved 3 pair of Nerves in all the broad-bill'd Birds that I could meet with, and in all ſuch as feel for their food out of their Sight, as *Snites*,

Woodcocks, *Curlews*, *Geeſe*, *Ducks*, *Teale*, *Widgeon*, &c. Theſe Nerves are very large, equalling almoſt the *Optick Nerve* in thickneſs; they begin a little more forward than the *Auditory Nerve* from a little Protuberance which ſeems to be made for them. One of them goes over the Optick Nerve in the Orbit of the Eye; the other two go under the Eye; two are diſtributed nigh the End of the upper Bill, and are there very much expanded, paſſing through the Bone into the *Membrane*, lining the Roof of the *Mouth*: the third Pair is diſtributed near the End of the lower Bill, and ſubdivided like the former. *Note*, that Birds that pick their Food where they can ſee it, have not theſe Nerves, and that the Pair of *Nerves* belonging to the upper Bill, is conſiderably ſmaller in Proportion to the Fowls, than thoſe obſerved above, whence it is probable that theſe *Nerves* are deſigned for ſome great uſe, both on the Account of their Number and their Largeneſs, and that the uſe to be aſſigned to them, muſt be to enable them to diſtinguiſh (whether by *Taſting* or *Feeling*, will not now determine) their Food, there being a Neceſſity of a more exquiſite Senſe in theſe *Fowl*, than in any other.

Fig. 246. The 246 Figure repreſents theſe in a *Duck*'s Head, where *aa* expreſſes the Edge of the *Cranium*, which is in Part removed for the more clear View of theſe Nerves; *bb*. are the Cells about the *Ear* between the two Tables above deſcribed; *cc*. the *Brain* laid bare, with its *Blood Veſſels*; *ddd*. the three *Nerves* on one Side; *e*. the *Optick Nerve*; *fff*. the Skin and Part of the Bone removed, to bring the Nerves in View; *gg*. the two *Nerves* Expanded near the End of the upper Bill; *hh*. that in the lower.

9. All the Eyes of a Fowl and of Fiſh, that I have examined, were more or leſs cartilaginous, for the *Sclerotis* is a *Cartilago ſui generis*, eſpecially near the *Cornea*, in all theſe Animals. And in the larger ſorts of both, I remember to have found the whole *Sclerotis* ſuch a kind of a Cartilage.

10. I have frequently obſerved in ſmaller Fowl that the Membrane of the *Drum* was *double*, for by gently pulling away the *Membrane* lining the *Tube* of the Ear, I have obſerved at the bottom of it a tranſparent Membrane; which at firſt I took to be the Membrane of the Drum, but upon Examination, I found that the Membrane of the Drum was ſtill entire, and in its proper Place. I have alſo ſometimes obſerved this in larger fowl, in a *Seal*, and in ſome other Animals, and perhaps it may be ſo in all.

By Mr. J. Clayton, n. 206. p. 990

2. Dr. *Moulen* and my ſelf, when we made our Anatomics together at *London*, ſhew'd to the *Royal Society*, that all flat-bill'd Birds, that Groped for their Meat, had three Pair of *Nerves*, that came down into their Bills; whereby as we conceived, they had that Acuracy to diſtinguiſh what was proper for food, and what to be rejected, by their Taſte, when they did not ſee it. This was moſt evident in a *Duck*'s Bill and Head, a *Duck* having larger *Nerves* that come into their Bills than *Geeſe*, or any other Bird that I have ſeen, and therefore *Quaffer* and *Grope* out their Meat the moſt. But I then diſcovered none of theſe *Nerves* in round bill'd

Birds. But ſince, in my *Anatomies* in the Country, in a *Rook* I firſt obſerved two *Nerves*, that came down betwixt the Eyes, into the upper *Bill*; but conſiderably ſmaller than any of the three pair of *Nerves*, in the *Bills* of *Ducks*, but larger than the *Nerves* in any other *Round-Bill'd Birds*. And 'tis remarkable, theſe *Birds* more than any other *Round-bill'd Birds* ſeem to Grope for their Meat in Cow-dung, and the like. Since I have found in ſeveral Round-bill'd Birds, the like *Nerves* coming down betwixt the Eyes, but ſo very ſmall, that had I not firſt ſeen them in a Rook, I ſhould ſcarce have made the Diſcovery. In the lower *Bill* alſo there are *Nerves* that have much the ſame Situation with the flat bill'd *Birds*; but very ſmall, and ſcarce diſcernable, unleſs to the cautious and curious.

The *Ears* of *Birds* differ much from thoſe of *Men* or *Beaſts*, there's almoſt a direct Paſſage from one Ear to the other of *Birds*, ſo that prick but the ſmall Membrane called the *Drum* on either Ear, and Water poured in at one Ear will run out at the other. But what is much more remarkable, they have no *Cochlea*, but inſtead thereof, there's a ſmall *cochleous* or *twiſting Paſſage* that opens into a large Cavity, that runs betwixt two Skulls, and paſſes all round the Head. The upper Skull is ſupported by many Hundred of ſmall thread-like Pillars, or *Fibres*, which, as we ſuppoſed, had another Uſe alſo, *viz.* to break the Sound from making any confuſed Echo, and to make it one, and diſtinct. This Paſſage we obſerved was much larger in *Singing Birds*, than in others that do not ſing, ſo very Remarkably, that any Perſon that has been but ſhow'd this, may eaſily judge by the Head what *Bird* is a *Singing-Bird*, or has Apitude thereto, tho' he never ſaw the *Bird* before, or knew what *Bird* it were. This has often made me reflect how much the *Modification* of Voices depends upon the *Accuracy* of the Ear, and how Deaf Perſons become Dumb: And ſince, I have obſerved that many Children that have an acute Wit enough, that are ſlow of Speech, that is, long before they ſpeak, are much longer before they can pronounce thoſe Letters that are ſharp, as *g. h. r.* and never have an Apitude to learn to ſing. ib. p. 998.

I have alſo anatomized moſt ſorts of Creatures, and never found any Four-footed Creature with an Ear like a *Bird*, unleſs a *Mole*, and a *Mole* has an Ear much like them, with a very thin double Skull, and a great Cavity like a *Bird*, and is very acute of *Hearing*: The Skull by reaſon of this large *Cavity*, being very ſlender, is eaſily *cruſhed*; ſo that a *Mole* is quickly kill'd with a bruiſe on the *Skull*, like a *Lark*, and upon the bruiſe, the Membranes of the Skull turn black; but when I have taken Care not to bruiſe the Skull the Membranes were not black at all.

The Anus of Fowls applied in malignant diſtempers, by Mr. J. Templer, n. 86. p. 5031.

XCVII. I have obſerved, by Inflation into the *Aſpera Arteria* of *Fowls*, hat there is a Continuation of many *Veſicles* extended from the *Bronchia* hrough the *Abdomen* to the *Anus*. This, I conceive to be the Cauſe of the onſtant Motion of the *Anus* in *Fowls*, the Air having Ingreſs and Egreſs here: And alſo that to be the Reaſon why the *Anus* of Fowls are in maliguant lignant *Diſtempers* applied to draw the Infection out of the *body*. For thoſe *Anus*'s being like *Cups* or *Ventouſes*, the fowl has often ſtuck by its *Anus* till it died, in which Caſe, I have known 7 Chickens applied to the Groin of one viſited by the *Plague*, that ſtuck till they dyed, and the Eighth went quickly off, and lived above 1½ Year after.

A Blemiſh peculiar to the Eyes of *Horſes*, by *Dr. Rich.* Lower, n. 32, p. 613.

XCVIII. 1. The *Eyes* of *Horſes* are peculiarly affected with one Defect, which no *Animal* beſides is troubled withal, as far as I have obſerved; and that is, a ſpungy Excreſcence (commonly of a dark musk Colour) which grows out of the Edge of that Coat of the Eye, called the *Uvea*. If this ſpungy Subſtance be ſo great, or the Number of them ſuch, as that they grow in ſeveral Places about the *Pupil* of the *Eye*, where it contracts it ſelf, the *Pupil* or *Sight* is very much (if not totally) obſtructed; and conſequently, the Horſe ſees very little, or nothing at all: As I have many times taken notice in ſome Horſes, which being brought into the Sun ſhine, could not ſee at all, but ſuffered me to touch the Sight of their Eye with my *Finger* without the leaſt Winking, which Horſes being led back into the *Stable*, the *Uvea* in that obſcure Place, dilating it ſelf, they could ſee very well again, and would not ſuffer me to ſhew my *Finger*, near to the Eye, without frequent cloſing their Eye lids, and toſſing their Heads. The ſame Horſes I underſtood by the Owners, were very apt to ſtumble in the Day time, if it were bright and ſunſhine, but *travelled* very well, and ſecurely in the *Evening*, and in *dark cloudy Weather*.

I cannot think that theſe Excreſcencies come from ſtraining in great *Draughts*, and *Races*, or from hard *Travel*: becauſe I have ſeen very large *Spunges* (as I may call them) in young Horſes Eyes of 2 and 4 Years old, before they were backed; which, after they have been taken up from the Graſs, and kept with dry Meat, have very much abated, and afterwards being turned to *Graſs* in the Spring to cleanſe and cool their *Bodies*, have increaſed again to the wonted bigneſs.

It is remarkable, that the more and greater thoſe *Excreſcencies* are, the more the *Pupil* of the *Eye* or the *Sight* is in Danger of being quite obſtructed, which you may further examine, by turning the *Horſe's* Eye to the *Light*, and obſerving how much of the Pupil they do obſtruct. That thoſe on the upper Edge of the *Uvea* are apt to grow the largeſt, and hinder the Sight moſt. And that that which grows on the middle of the *Uvea*, does more hinder the *Sight*, by diſtracting the Object, than that, which grows in either Corner or Angle of it.

I ſuppoſe no Cure can be expected but from a drying Kind of Dyet; yet perhaps outwardly ſomething may be Deviſed to ſhadow the Eyes, and keep 'em from being Nakedly Expoſed to the Sun, whereby the Pupil will not be ſo cloſely contracted, and conſequently, the *Sight* not ſo much obſtructed.

By [illegible] n. 37. p. 750.

2. Horſes of an *Iron Grey*, or *Dapple Gray*, are frequently inclining to loſe one or both Eyes, if Back'd or hard Ridden too ſoon.

In Man and Beaſt, (in Horſes at leaſt) the right Eye is the weakeſt, and moſt frequently failing.

The *Pupil*, or Black of the Eye is wider and larger in thoſe that are ſhort-ſighted, than in thoſe that ſee at greater Diſtance.

I have often noted ſome that are ſhort-ſighted, I ſay not Pore-blind, to diſcern all things that are done about them, almoſt quite behind them, more perfectly than the beſt ſighted, if the Room was not too large for the Reach of their Sight.

Alſo ſome of Dr. *Lower*'s Obſervations, I could confirm by my own Experience. In my youngeſt Days, I had a very narrow Eſcape from an excellent Horſe, which had that only Defect, which they call *Moon-blind*, (and they told me of it after the Miſchief:) I purpoſed to leap a Ditch, but the Horſe ſaw no Ditch, ſo we fell in together.

As Coach and Cart Horſes have Flaps on the Ear ſides of their Eyes, ſo theſe Flaps may be fitted (and in ſome Shew of Ornament) to ſhadow the over Part of the Eyes, and yet to afford them Light enough to ſee their Way. I know not whether it be uſual amongſt you, but I have ſeen a young Child wear a kind of black Ribbon, like a narrow *Mask* before her Eyes, the Ribbon or *Mask* having Holes made in fit Places to guide the Eye: And this was ſaid to be an effectual Remedy to cure the Child of Squinting, which ſhe had hereditarily from her Mother.

A Horn hanging at the Neck of an Ox, by S. Malphigi, n. 166. p. 601.

XCIX. Duodecimus jam excurrit Annus, quo mactandum bovem luſtravi cum præclariſſimis Viris D. *Carolo Fracarſato*, & D. *Silveſtro Bonfiliolo*, a cujus Collo in dextris, ubi jugum apponitur, inſigne pendebat Cornu. Hujus Longitudo 16 *Digitorum* craſſitiem æquabat, Non longe a baſi, ubi Latius erat, 8 *digitorum* Latitudinem explebat. Ejus forma conica erat, & in obtuſum deducta Apicem, non parum verſus Finem curvabatur. In baſi tamen ubi Collo nectebatur, arctius erat. Color circa extremitatem ſubniger Luciduſque erat; & perſimilis ei, qui in *Ungula Bubula* paſſim obſervatur. Exterior *Superficies* aſpera erat, præcipue a Baſi uſque ad medium; etenim Cuticula & ſubjectum *reticulare Corpus* cum contentis *Papillis* (quæ in aliis partibus perpendiculariter attolli ſolent, ac *Tactus Organum* conſtituunt) ſenſim produci inclinarique incipiebant, non diſpari ſpecie, ac in noſtrorum Digitorum extremitate, quilibet prope *Unguium* Radicem obſervare poteſt. Papillæ igitur, Laciniata Cuticula, & reticulari Corpore circumdatæ, majorem Longitudinem ſortitæ ita inclinabantur, & invicem hærebant, & ferruminabantur extremis Finibus, ut ſquammoſum *Piſcium* Tegumentum æmularentur. Circa Baſim ſquammoſa hæc corpora brevia erant, ſenſim vero producebantur & prope Conum longiſſima reddebantur. Varius quoque erat ſubſtantiæ Modus; nam in Baſi *Papillaria* hæc Corpora non ita ſibi mutuo connexa conglutinabantur, ſed ſolutis ipſorum Finibus laciniatum & aſperum excitabatur Corpus. Ultra tamen Medietatem denſiori donabantur compage, unde & lucida & levia videbantur. Interius expoſitum *cornu* concavum erat, ita ut Craſſities ipſius in Baſi nativam *Corii* altitudinem parum excederet; gracileſcente tamen & attenuato *Corio* ad Naturam quaſi *Mem-*

brana, intus ambiebatur, quod *ſanguinea vaſa* irrigabant; hocque detracto ſolidum & leve corpus occurrebat. Tota Concavitas referta erat ſubflavo, turbidoque ſero, quod igni appoſitum totum fere in Naturam Albuminis Ovi concreſcebat. Sub Baſi Glandulæ conglobatæ, depreſſæ tamen inſigniter, luxuriabant.

Ex hujus igitur diligenti Inſpectione patet, *Papillas* (quas non incongrue externi *Tactus Organa* credidi) *Cuticula* & *Reticulari Corpore* cuſtoditas, ubicunque plus juſto producuntur, & invicem intime unitæ ferruminantur, in ſolidum deſinere Corpus; quod commune eſt *Ungulis* & *Cornubus*, quæ ſola exteriori Configuratione, & majori minorive Partium denſitate donata, ad invicem diſcriminantur; unde veluti Senſorii Additamentum cenſenda veniunt, & Tactui quoque non parum conducentia. Cornuum e Cranio erumpentium obſervata Productio his multum lucis confert. Hanc itaque Vegetationem in Bove deprehenſam in Phyſicæ additamentum audire ne graveris.

In *Fœtu* igitur adhuc in Utero contento, *Cranii Os* in ſitu Cornuum fere Cartilagineum eſt, & poſtremo Oſſeam Naturam acquirit. *Pili* ibidem primo erumpunt Glabro exiſtente Corio præter Labia, quæ quibuſdam *Pilis* ornantur. Hi taliter locantur, ut ipſorum Ordines a Circumferentia verſus Centrum ſituati & inclinati minimum quaſi Conum efforment. Poſtremis quoque Menſibus, in Fœtu adhuc concluſo, Oſſeæ Laniellæ (quibus Cranium compaginatur) obliquari incipiunt, & fracta Directione extra eminent, excitatis intro ſubrotundis ſpaciolis, unde ſupra Cranium oſſeus tumor primo emergit lenticulare corpus præ ſe ferens. Hoc extenſo Corio cooperitur, quod præ reliquis craſſum eſt, & turgentes exhibet *Glandulas*. Inter oſſeum Corpus, & Corium, Perioſteon, ſeu *Oſſea ſubſtantia* inchoamenta locantur, quæ paulatim manifeſtantur. Extra *Uterum* ſenſim oſſeus Tumor lenticularis parum aſſurgit turgentibus oſſeis Lamellis. Supra Os craſſum luxuriat Perioſteon, ſeu futuri Oſſis Inchoamentum. Corium quoque obducitur, a quo Tactus *Papilla* aſſurgentes reticulari & cinereo Corpore ambiuntur: Hoc copioſis Pilis, diverſam Inclinationem ſortitis, cooperitur. Altero elabente Menſe, Oſſea ſubſtantia Laminulis & ſpatiolis contexta extuberat, ita ut Cornu rudimentum emergat, dimidiam Digiti Craſſitiem æquans, & Conoidem Parabolicum repræſentans. Hujus exterior Superficies lævis & glabra ſenſim redditur, nigroque inficitur Colore. Corium craſſum de more extenditur, a quo *Tactus Papilla* erumpentes, ſuperato *Reticulari* Involucro, quod Cinerea eſt, elongantur, & nigro ambiente Succo conglutinantur. Hæ circa Cornuum Baſim inclinatæ verſus Apicem diriguntur: Reliquæ vero ab Apice exortæ Perpendiculares quaſi aſſurgunt, & *Reticulari* Corpore cuſtodiuntur; earum Longitudo vix *Serici Villoſi* Lanuginem æquat. Interea incluſa oſſea Appendix Augmentum capit & Interius varie Configuratur. Etenim ut plurimum Radix Fiſtuloſa excitatur Subſtantia quæ Oſſeis Fibris reticulariter implicitis componitur; reliquum vero uſque ad Apicem Spongioſo conſtat Corpore. Sanguinea intercurrunt Vaſa, & Apex perpetuo *Submollis* firma Partium compage non gaudet. *Corium* quoque extenſum *Oſſeam* Subſtantiam inveſtit, & in baſi Craſſius eſt. Ab hoc itaque immergentes *Tactus Papillæ* ita Proceræ redduntur, ut inclinatæ verſus Apicem, ſimulque *reticulari Corpori* unitæ, tot *Conica* Corpora concava efficiunt, & ex horum unione (quaſi tot Lamellis, Cæparum inſtar, intra ſe poſitis) ſolidum Cornu corpus efficiatur. Papillarum Ordines in baſi erumpentes, licet non omnes Apicem attingant, ut plurimum tamen recta deducuntur, & fere Cornu ambiunt; aliæ quoque ſub diverſis Planis a producto Corio propagantur, quæ longiores redditæ, breviores cooperiunt & includunt, unde ſecto per longum Cornu non ſolum Oſſea ſubſtantia occurrit, ſed etiam Corium a quo molles Papillæ emanant, quæ in Cornuum Subſtantiam immutatæ ſolideſcunt & nigreſcunt, avulſoque oſſe cum ambiente corio, Fiſtulæ in cornu a reticulari opere excitatæ patent. Occurrunt quoque papillarum tactus varii exortus & plana, ipſarumque Productio uſque ad Apicem; unde cum diverſa plana extremum *conum* conſtituant, hinc eſt, quod Apicis ſubſtantia craſſitiem fere digiti æquat. Exaratæ *Papillæ* baſim cornuum excitantes molles adhuc ſunt, & de facili lacerantur, vel in furfures abeunt; circa finem vero & apicem ita addenſantur, & *reticulari corpore* ferruminantur, ut ſolidæ factæ *nigro lucidoque* inficiantur Colore. Harum progreſſus evidens eſt; nam tot quaſi Filamentis, per longum ductis, coagmentari videntur.

Procerioribus redditis *cornubus*, ita ut 12 *digitorum* craſſitiem æquent, incluſa Appendix Oſſea longior redditur; & ubi continuo & pleno Oſſe non coagmentatur, variis *cellulis* concameratur & excavatur. Secto autem Cornu per longum, ſingula dilucidius patent; primo enim frequenter exarata Appendice oſſea lamina componitur, ita ut *Tubus* efficiatur: Portiones tamen oſſea oblique per tranſverſum ductæ inſeruntur, unde relictæ Areæ concavitates oblongas, inæqualis tamen Longitudinis & Figuræ, efficiunt, in quibus aliæ quoque ab aſſurgentibus parum Oſſeis Parietibus deſignantur. Omnes hæ Concamerationes Membrana tenui obducuntur, ſub qua ſanguinea *Vaſa* in miras Propagines diramata cuſtodiuntur. Verſus Apicem Oſſea ſubſtantia ſpongioſa eſt nullis Cellulis excavata, unde impenſe rubet ex innumeris Vaſculis, quibus irrigatur.

Expoſitam Appendicem oſſeam extenuatum Corium ambit, a quo molles de More *Tactus Papillæ* emanant, quæ *reticulari corpore* cuſtoditæ, ſimulque ferruminatæ, verſus Apicem deductæ Cornu componunt, ita ut Cornuum Parietes in Baſi Graciles ſenſim ex *Papillarum* Additione reddantur, & tandem in Apice ex omnium Unione, Duorum Digitorum Craſſitiem æquent.

Horum interior Superficies nigra eſt, & fiſtuloſis Foraminulis verſus Apicem directis exaſperatur, quibus Papillæ admittuntur. Exterius Apex Acuminatus, Solidus, Lucidus & Ater eſt; Verſus Medium tamen ſubalbeſcit Cornu, & circa Baſim parum nigreſcit, & de facili in Squammas ſolvitur.

Ulterius tandem Augmentum ſortiuntur Cornua, ita ut urgente interiori Oſſea Appendice primi *Papillarum* Ordines a Baſi erumpentes, avulſi a Corio ſeparentur, & ita diverſi Fines & *Papillarum* Limbi apparent ; non diſpari ritu ac in Conchis Marinis conſpicimus, quarum Compoſitio diverſis Teſtulis ſuperpoſitis, in æqualibus tamen, coagmentatur, ita ut extremi Fines quarumcunque *Teſtularum* minimum eleganſque exhibeant planum. Hæc eadem Structura evidenter quoque in *Dorcadis Cornubus* eluſceſcit, unde a Radicibus uſque ad Medium Aſperitates, quaſi Nodi, obſervantur, quæ a diverſis *Papillarum* Lamellis vario tempore a *Corio* avulſis, & ſurſum retractis excoriuntur, quæ omnia diligenti Microſcopii luſtration patent.

Poſtremo tandem Cornua ultimum ſortita Incrementum non parum immutantur : nam exterius ipſorum Color varius efficitur, Subſtantia quoque ſolidior reddita, Diaphana fere evadit, & continuo Uſu lævigatur. Interius Oſſea Appendix obtuſo terminatur Fine, totaque ipſius longitudo gracilente Corio adhuc tegitur. Ab hac Emergentes olim Tactus *Papillæ* obliterantur, præterquam in Apice : Interior enim Cornuum Superficies evaneſcentibus Vaginulis, ſeu Reticularis Corporis Finibus, ex Ferruminantis Succi exundante Copia, tota fere circa Baſim Lævis & Perpolita redditur, ita ut *Papillarum* Productiones quaſi obſcurentur.

Analogam quoque Generationem in *Gallorum Calcaribus* obſervamus, quæ ex Cuticula & ſubjectis *Papillis Reticulari Corpore* conditis conflantur, ita ut turgente intus Oſſea Appendice exterius quoque Corium multiplicibus *Cuticulæ* involucris obductum rapiatur, & novum quaſi cornu, licet minimum, erumpat.

Ex his igitur conjectari licet, Monſtroſum Cornu in Bove Ortum traxiſſe non tam ex ulteriori *Papillarum, Corii, & Reticularis corporis* productione, ſed ex conatu interioris Tumoris, & ex Compreſſione facta in Cervice a proximo Jugo ; in Naturali namque Cornuum Eruptione emergens Oſſea Appendix extenſam ſibi Corii Portionem ſenſim urget, ſecumque rapit, ita ut *Papillæ* verſus Apicem inclinatæ elongentur. Proceriores autem redditæ ſunt, in Monſtroſo Cornu, Tactus Papillæ ex copioſo fortaſſe Succo per Filamentorum Reticularem contexturam, qua Corium componitur, excurrente vel elabente in Continuatas *Papillas*, & in Muſcoſum Reticulareque Corpus, ut in Ungularum Vegetatione contingit, quæ cum extremis *Papillarum* Finibus excitentur, in Deformem producerentur Longitudinem, niſi vel Arte, vel Attritu mutilarentur. Probabile quoque eſt ex Urgente aſſidue Jugo proximam Cervicis Partem compreſſam & inde Calloſam redditam fuiſſe : Sanguinis namque Motus non ita feliciter Celebratus eſt ; Ichoris quoque & Lenti Humoris per exaratam Corii contexturam ulterior Fluxus impeditus eſt ; & Sudoris Halituſque Effluvia per propria Sudoris Vaſcula ſuppreſſa ſunt, unde Corii Papillæ ultra Augmentum in novum Situm & Compagem adaptæ

ſunt & *Reticulare Corpus*, quod alias *Mucoſum* eſt, pene *Oſſeam* nactum eſt Conſiſtentiam. Hæc autem Ferruminatio probabiliter contigit ex *Vitriolato* Humore per *Excretoria Sudoris vaſa* effluente, vel ſaltem ab *Acidis Effluviis* Coercitis & *Fixatis*, dum interim Evaporantibus *Alcalibus* & *Aquoſis* Particulis *Sanguinei* inſtar *Seri* Solidum, Lucidumque fere Corpus excitatum eſt.

A Lamb Suckled *by a* Weather; *By* Mr. Tho. Kirke. n. 214 p. 263.

C. Sir *Will Lowther* (in *Yorkſhire*) had a *Lamb* 1694. which, being left by the *Ewe*, *Suck'd* a *Weather* (*Aries Caſtratus*) and brought him to *Milk*; and was maintained by him all Summer till the latter End of *Auguſt*, that he was *Weaned*. I ſaw his *Vdder* the latter End of *September* each ſide whereof was about the bigneſs of a Hen's Egg; and he had 2 conſiderable *Teats*. I ſaw *Milk* ſpurted out of them, to a Yard or two's Diſtance, notwithſtanding the *Lamb* had been taken from him ſo long. In *November* I ſaw him again, but his *Vdder* was then much fallen, each ſide being now about the bigneſs of a *Walnut*; there is *Milk* ſtill in it, enough to Stream out above half a Yard.

There are no Tokens at all, of an *Hermaphrodite* in him. I compared him with another *Weather*, who had *Teats* or *Paps* like him, and differed in nothing but the *Vdder*. The *Ewe* died upon Shearing, when the *Lamb* was about five Weeks Old; ſo 'tis likely it might feed partly upon Graſs, as I ſuppoſe other *Lambs* of the like Age do notwithſtanding what they Suck from their Dams.

Graſs *found in the* Wind-Pipes *and* Lungs *of ſome* Animals, *By* Mr. Rob Boyle. n. 6, p. 100.

CI. Dr. *Clark* and Dr. *Lower* have given me an Account of a pretty odd kind of Obſervation: One of them aſſuring me, that he had ſeveral times, in the *Lungs* of *Sheep* found a conſiderable quantity of Graſs, in the very *Branches* of the *Aſpera Arteria*; and the other relating to me, that a few Weeks ſince, he, and a Couple of Phyſicians, were invited to look upon an *Ox*, that had *two* or *three* Days almoſt continually held his Neck ſtraight up, and was Dead of a Diſeaſe the Owner could not conjecture at; whereupon the Parts belonging to the Neck and Throat being opened, they found the *Aſpera Arteria*, in its very Trunk, all ſtuffed with Graſs, as if it had been thruſt there by main Force: Which gives us juſt cauſe to wonder both how ſuch a quantity of Graſs ſhould get in there; and how, being there, an Animal could Live with it ſo long.

A Murren in Switzerland *and it's* Cure, *By Dr.* Wincler. n. 146. p. 93.

CII. 1. On the Borders of *Italy* a *Murren* infected the *Cattle*, which ſpread farther into *Switzerland*, the Territories of *Wirtemburg*, and over other Provinces, and made great Deſtruction amongſt the *Cattle*. The Contagion ſeemed to Propagate it ſelf in the form of a *Blue-Miſt*, that fell upon thoſe Paſtures where the *Cattle* Grazed, inſomuch that whole Herds have returned Home Sick; being very Dull, Forbearing their Food, moſt of them would die away in 24 Hours. Upon *Diſſections* were diſcovered large and Corrupted *Spleens*, *Sphacelous* and Corroded *Tongues*, ſome had *Angina Maligna*'s.

Thoſe Perſons that careleſly managed their *Cattle* without a due reſpect to their own Health, were themſelves *Infected*, and dyed away like their Beaſts. This *Contagion* may probably proceed from ſome *Noxious Exhalations* thrown out of the Earth, by 3 Diſtinct *Earthquakes* perceived here and in our Neighbourhood in the ſpace of one Year.

The Method of Cure was thus; as ſoon as ever there was any Suſpicion of the *Contagion* upon any one of the Herd, the *Tongue* of that Beaſt was carefully Examined: In caſe they found any *Aptha* or *Bliſters*, whether *White*, *Yellow*, or *Black*, then they were obliged to rub, ſcratch and tear the Tongue till it *bled*; then they wiped away the *Blood* and *Corruption* with new unwaſhen Linen: This done a *Lotion* for the *Tongue* was uſed, made of *Salt* and good *Vinegar*. The *Antidote* for the Diſeaſed *Cattle*, and the *Medicine* for the Sick was the ſame. *viz.* Take of *Soot*, *Gun-Powder*, *Brimſtone*, *Salt*, Equal parts, and as much Water as is neceſſary to waſh it down; give a large Spoonful for a Doſe.

By Dr. Fred. Slare, ib. p. 94. 2. I am aſſured, by *two* ingenious Travailers, that this Contagion reach'd the Borders of *Poland*, having paſſed quite through *Germany*; That it was obſerved to make its Progreſs daily, ſpreading near *two German Miles* in *twenty four Hours*; that it continually without Intermiſſion made Progreſſive Voyages, and ſuffered no Neighbouring Pariſh to Eſcape, ſo that it did not at the ſame time *Infect* Places at great Diſtances, that *Cattle* ſecured at *Rack* and *Manger* were equally Infected with thoſe in the *Field*. It were worth conſidering whether this *Infection* is not carried on by ſome *Volatile Inſect*, that is able to make only ſuch ſhort *Flights* as may amount to ſuch Computations.

The Diſeaſes of Dogs, By S. Theodore Mayern. n. 191. p. 408. CIII. Dogs are ſubject to theſe Diſeaſes. 1. The *Hot-madneſs*, which is Incurable; they fly upon every thing, and can hold out but 4 Days. 2. The *Running-madneſs*, which is likewiſe Incurable; they fly only upon Dogs, and that by Fits, and may ſometimes hold out *nine* Months. 3. *La Rage Mue*, which is a Diſeaſe that lies in the *blood*. 4. The *Falling-madneſs*, which Seiſes on the Head, and is a ſort of *Epilepſie*. 5. The *Blaſtin* or *Withering*; this lies in the Bowels, which ſhrink up exceedingly. 6. The *Sleepy Diſeaſe*, which comes from little Worms in the Mouth of th Stomach, theſe *Dogs* die Sleeping. 7. The *Rheumatick Diſeaſe*, this Swel the Head very much, and makes the Eye Yellow. In theſe five latter Dif eaſes the *Dogs* will not Eat, (nor at any time when they are Sick,) bu they Live *eight* or *nine* Days without Hurting any Body, and then die Hunger.

The two firſt are Catched by the Breath of Dogs being together in the Plague among Men: the latter are likewiſe *Contagious*, but Cu rable.

CIV. T

Obſervations on the Diſſection of a Rat, By Mr. Rich. Waller. n.166. p.594

CIV. The Fore-feet of a *Rat* reſembleth thoſe of the *Caſtor*; The Hair is alſo ſome Fine, ſome Courſe, as in that Animal; the *Tail Scaly*, with Hairs between every *Scale*, like the *Caſtor*'s, which ſhews theſe two Animals to be ſomething a-kin: and indeed the *Water-Rat* comes very near to the *Beaver*, and makes its Holes in the bank ſides of Ponds after the ſame manner.

*Fig.*247.

The *Penis* in the *Rat* has a particular Paſſage near the *Navel*, as in *Squirrels*, and not at the *Anus*, as in the *Caſtor*.

The *Liver* is full of little *Specks*, as big as Pins heads; which are the little *Glands* thereof.

There was no *Gall Bladder*, but a *Ductus Felleus*, poſſibly the *Bladder* was incloſed in the *Parenchyma* of the *Liver*, as it is in ſome Animals.

The *Cœcum* was much larger than the Stomach, and in ſhape like that of the *Caſtor*.

The *Teſticles* lay not behind, but in the *Groins* on the *Os Pubis*. Theſe were like a *bottom* or Skein of *Thread* Rumpled up together, which was Viſible through the *Coats* of the *Teſticle*. This *Thread* continued of near the ſame ſize in the *Epididymides*, only towards the *Deferentia* it grew larger.

It was tender, and not eaſie to be unravel'd; ſo that I could not draw out above *three Quarters* of a *Yard*.

The *Proſtata* lay under the *Spermatick Arteries*.

The *Kidneys* were *Whitiſh*, with their *Succenturiati*.

At the Neck of the Bladder were inſerted the *Veſiculæ Seminales*; Tranſparent and filled with the *Semen*.

Toward the End of the *Penis*, which had a Bony *Griſtle*, were two large *Glands*, emptying themſelves near the End of the *Penis*, and contained a Subſtance like *Cream*, as in the *Dormouſe*; obſerved by *Swammerdam*.

Explication of the Figure

A A. The *Kidneys*, *a a*. the *Renes Succenturiati*; *bb*. the *Ureters*; *c c*. the *Crural Veins* and *Arteries*; *D*. the *Arteria Magna*; *e*. the *Vena Cava*, *F*. the *Bladder*; *g g*. the *Spermatick Veſſels*, *Veins* and *Arteries*; *h h*. the *Teſtes*, with the Branches of the *Veins* and *Arteries*; *i i*. the *Epididymides*; *k k*. the *Deferentia*; *l*. the *Penis*; *m m*. the *Veſiculæ ſeminales*; *n n*. two *Glands*, from whence a thick Juice might be preſſed out; *o*. the *Balanus*.

Sable Mice, By Sir P. ycaut. n.251. p. 110.

CV. 1. The *Sable-Mice* (which were firſt obſerved in *Lapland* about *Thorne* 1697) are near as big as a little *Squirrel*: their Skin ſtreaked, and ſpoted *black* and *light-brown*; they have 2 *Teeth* above, and as many under, very ſharp and pointed; their Feet like thoſe of *Squirrels*, they are ſo Fierce and Angry, that if a ſtick be held out at them, they will bite it, and hold it ſo faſt that they may be ſwing'd about in the Air; they are fat and thick, and without any *Tail*.

In their March they keep a *Direct Line*, generally from *North Eaſt* to *South-Weſt*, and are innumerable *Thouſands* in each *Troop*, which for the moſt part is a Square: they March by Night, and in Twilight, and lie Still by Day. The diſtance of the Lines they go in, is of ſome Ells, and Parallel to each other. If they meet any thing that might ſtop them, they avoid it not, tho' it were a Fire, a deep Well, a Torrent, Lake, or Moraſs, but without any Heſitation Venture through, and by that means, many *Thouſands* of them are deſtroyed. If they be met Swimming over Lakes and be forced out of their Courſe, they preſently Return into it again, when they are met in Woods or Fields and ſtopt, they ſet themſelves upon their hinder Feet like a Dog, and make a kind of Barking or Squeeking Noiſe, leaping up as high as a Man's Knee, defending their Line as long as they can: and if at laſt they be forced out of it, they Creep into Holes, and ſet up a Cry ſounding like *Biabb, Biabb.* They never come into any Houſe, nor meddle with any thing that is Man's Meat; if a Houſe happen to be in their Way, there they ſtop till they Die, but through a Stack of *Hay* or *Corn* they will Eat their Way; when they March through a *Meadow*, they endamage it much, by Eating the *Roots* of *Graſs*, but if they Encamp there by Day they quite ſpoil it, and make it look as if it were burnt, or ſtrewed with Aſhes. The *Roots* of *Graſs* with *Rotten Wood*, and the *Inſects* in it, are their Chief, if not only Food.

Theſe Creatures are very Fruitful, yet their Breeding does not hinder their March, for ſome of them have been obſerved to carry one Young One in their Mouth, and another on their Back.

It is reported that ſome Poor *Laplanders* have Eat ſeveral of them, and found their Fleſh to Taſte like Squirrels: Dogs and Cats Eat only the Heads, and Birds of Prey only their Heart. During the *Winter* they lie under the Snow, and have their Breathing Holes upon the top of it, as Hares and other Creatures uſe to have. The Country People are very Glad of theſe Gueſts, foretelling there will follow great Plenty of Game, as of Fowl, Squirrels, Lo-Cats, Foxes, *&c.* where of late Years there has been great Scarcity, being told by ſome old People that theſe ſort of Creatures were ſeen in *Lapland*, about 20 or 30 Years before, and that thereupon they had Abundance of ſuch Game.

By —— ib. p. 812.

2. Theſe *Mice* are the ſame with thoſe called *Mures Norwegici*, deſcribed by *Olaus Wormius* in his *Muſæum*.

The Ruſſian Way *of* curing Caſtoreum; *By*.... n. 162. p. 501

CVI. Take *Beaver Stones*, and get the Milk out of them as clean as you can, then ſet upon the Fire a Skillet or Kettle with Water, big enough to contain the quantity of Stones you have to Cure: let the Water Boil, and put into it half a Shovel-full of Clean Wood Aſhes, then tie the Stones together in Couples, and put them into the Water, and let them boil therein for half a quarter of an Hour, then take ſome Birch Bark and lay it on the Fire, and let the Stones be well Smoaked over it for the ſpace of an Hour, until they are well dried in the Smoak, then hang them up in a Kitchen, or in the Air, for a Week or more, until they are perfectly dry and hard; after which they may be packed up in a Caſk, or otherwiſe, for *Tranſportation*.

Fig.

Fig

Fig.

Fig.

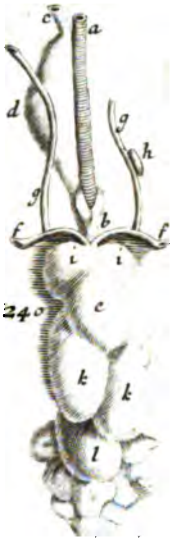
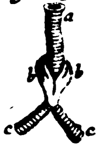


Fig. 240.

Fig. 241.



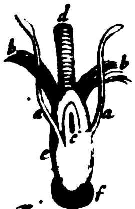
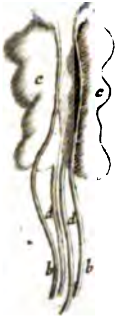


Fig. 242.

Fig. 243.



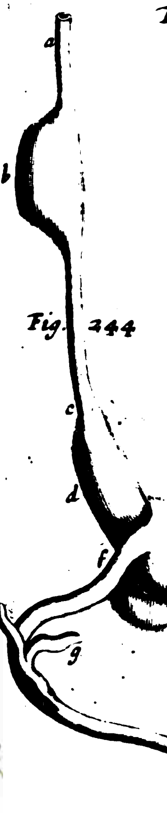
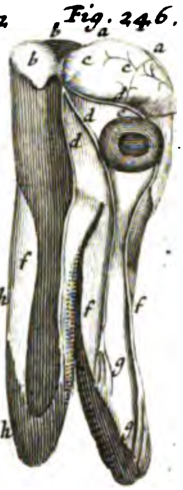
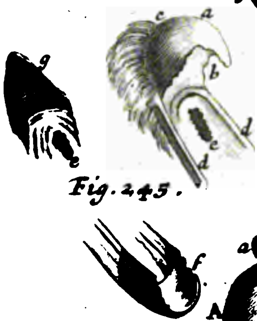


Fig. 244

Fig. 246.





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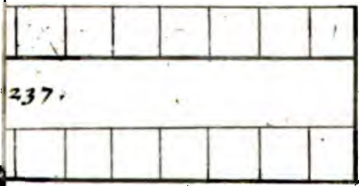


237.

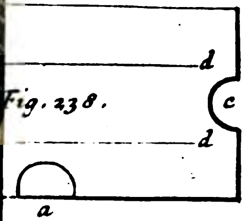
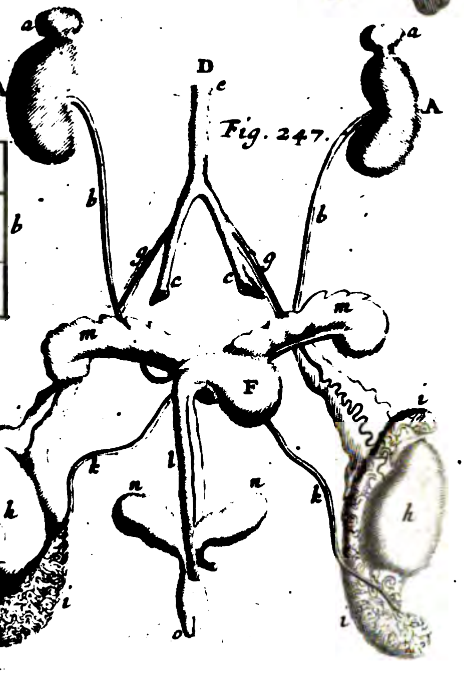


Fig. 238.

Fig. 247.



The Musk-quash; By. n 127. p. 653

New England's Rarities.

The Anatomy of a Mexican Musk Hog, By Dr. Edw. Tyson. n. 153 p. 359.

Fig. 248.

Fig. 250.

By ———
ib. p. 612.

The Ruſſian
Way *of* cur-
ing Caſtore-
um; *By*. . . .
n. 162, p. 501

CVII. That the *Teſticles* of the Animal in *New England* call'd *Musk-quaſh*, doſmell ſtrong of *Musk*, as Mr. *Joſſelin* ſaith, is moſt certain: For, I have known ſome of them kept a long Time in ones Pocket, till they were become hard and black, and yet Smelt as ſtrongly as at firſt, which in my Opinion, was nothing inferiour to the Scent of that which is commonly ſold for *Musk* in the Shops. I remember that one of our Seamen, being laid to Sleep too near the Fire-place, with one of theſe dried *Teſticles* in his Pocket, it happened that a Coal burned through his Breeches to it, and made ſo great a Scent of *Musk*, that he might eaſily have been ſmelt a good way off.

The Musk-quaſh; By n. 127. p. 653.

New England's Rarities.

This Animal deſerves to be further enquired into, eſpecially if what M. *Thevenot* relates be true; *viz.* That *Musk* is nothing elſe but the *Teſticles* of a Beaſt like a *Deer*, found in *China*, in the Province of *Honan*.

CVIII. The whole Shape of this Animal (which by ſome Authors is called *Tajacu*) was ſuch, that we may eaſily reduce it to the Swine-kind, as plainly appears by the Figure: but it was much leſs than our uſual *Hogs*; for from the End of the Body, where the *Tail* ſhould be, to the top of the Head between the Ears, was 2 Foot and 2 Inches, from thence to the end of the *Noſe* 11 Inches. The Girth of the Body 2 Foot; the Girth of the Neck 16 Inches; of the Head, in the largeſt place, 18 Inches; and of the Snout 12 Inches: For the lower Jaw in this *Mexico-Hog*, was more Protuberant, and the Head leſs tapering than in our *Swine*, and in the *Sceleton* appears much like that of the *Baby Rouſſa*, only it had not thoſe *Teeth* and the *Neck* appeared ſo very ſhort and thick, not from thoſe large *Glands*, which in ſome of the *Swine-kind* do ſo ſtuff out their *Necks*, but from the ſhort turning upwards of the *Vertebræ* of the *Neck*, which were kept ſo cloſe to the Body, by the Inſertion of that ſtrong *Ligament* into the *Poll* from the *Back*, which in Animals that are *Prono Capite*, is of extraordinary Uſe, and much adds to the Strength of this Animal. The Colour of the Body was *Griſly*; being beſet with *Briſtles*, which were thicker than thoſe of a *Hog*, and leſſer than thoſe of a *Hedge Hog*; but like thoſe of a *Hedge-Hog* or the *Quills* of a *Porcupine*, they were Variegated with *white* and *black* Rings. The *Belly* was almoſt bare. The *Briſtles* on the Sides were ſhorter, and gradually increaſed in length, as they approach the Ridge of the *Back*; where ſome were 5 Inches long. Between the Ears, on the Head, was a large *Tuft* of theſe *Briſtles*; which were for the moſt part *Black*. The Ears were about 2½ Inches long and pricking up; the Eyes (as they are uſually in *Piggs*) but ſmall; for the lower *Canthus* to the End of the Noſe, 6 Inches; the Noſe like that of a *Hog*, the Mouth not large, the ſide of the lower Lip made ſmooth, as it were by the Rubbing of a *Tusk* in the upper Jaw; the Feet and Claws perfectly as in common *Hogs*, only the upper Claws on the ſame Foot proportionably longer, being one Inch and a Quarter long, whereas the *True-Claws* were ſcarce one Inch and an Half. It had no *Tail*. But

The Anatomy of a Mexican Musk Hog, By Dr. Edw. Tyſon. n. 153. p. 359.

Fig. 248.

Fig. 250.

what is moſt particular, and Differences it from any other Animal I know of in the World, is the Feet, or Navel, or Foramen rather, on the hinder part of the *Back*.

Theſe Animals are bred in *New-Spain*, *Nicaragua*, *Terra Firma*, and *Braſile*: They are uſually met with in the Mountains and Woods, and go in *Herds* together. They Feed on *Roots*, *Acorns*, and *Fruits*: but, as the greateſt Delicacy, they Hunt for all manner of *Poyſonous Serpents*, and *Toads*; and having caught them, holding them with their Fore-Feet, with a great deal of Dexterity, with their *Teeth*, they ſtrip off their Skin from the Head to the Tail, then greedily Devour them. *Poſtea* (ſaith *Jo. Faber*, who had the Account from *F. Gregorius*, who often has ſeen them, and lived in thoſe Parts 24 Years) *Radicem ſeu certa Arboris Corticem ſibi notum querit, quem comedit, ne Veneno inficiatur; & hac ratione optime Nutritur, Creſcit & Augeſcit.* When they are made tame, they will feed on any thing; but naturally they are very Fierce.

Hiſt. Anim. Mexican.

Ovideus Remarks that the *Swine*, which the *Spaniards* left on the Iſlands of St. *Domingo*, St. *Joannes*, and *Jamaica*, Multiplied and Encreaſed; but thoſe in *Terra Firma* durſt never go in the Woods, but were deſtroyed by the *Lion*, *Tygers*, and *Lupi Cervarii*: Yet in theſe Woods there are great Herds of theſe *Tajacu's*, that can make their party good with the Fierceſt of them. If any be Wounded, preſently he gets to his Aſſiſtance a great Number of his Kind, and never leaves till he has Revenged the Injury or is Slain. They are always at Enmity with the *Tygers*; and there is often found the Body of a *Tyger*, and abundance of theſe *Tajacu's* Slain together. If they ſpy a Man they will fiercely ſet on him, and his beſt Eſcape is to get up a *Tree*, which they will moſt furiouſly aſſault with their *Teeth*; nor will eaſily leave him, till forced by *Hunger*, or Slain by him, by *Club*, *Darts*, or a *Gun*. If they hunt them, their *Dogs* are often torn in pieces by them. Their Fleſh is Eſteemed very good, and much deſired by the Inhabitants. They have but a very little Fat. Our Subject had ſcarce any.

We come now to the *Anatomy*; having therefore divided the *Muſcles* of the *Belly*, we took notice of the Remarkable Structures of the Stomachs; for it had three. Into the middlemoſt was inſerted the *Oeſophagus*, or *Gullet*; which we therefore ſhall call the *Firſt Ventricle*, or *Stomach*. From this, on one ſide was a large Paſſage into the Second, which Pouching out had its two Ends winding like a *Horn*, and on the other ſide of the Firſt or Middle-Stomach, was a free open Paſſage into the third which Emptied it ſelf into the *Duodenum*. The Firſt Stomach was lined within, with a white thick hard *Membrane*; almoſt like the inward Pellicle of the *Gizard* of *Fowls*; with which none of the other Stomachs were endowed. For the Inward Surface of the Second, was ſmooth and ſoft, its *Membranes* thin, and more Enclining to the Common make of that of *Carnivorous Animals*: The third ſomewhat like this, but thicker and rimpled within, with large *Plica*, or *Folds*. Dr. *Grew* takes Notice that in the *Common-Hog*, againſt the *Pylorus*, ſtands a round *Caruncle*, as big as a ſmall *Filberd Kernel*, like a ſtopple to the *Pylorus*, for Preventing

Fig. 253.

Fig. 254.

Sto. and Guts of Quadrup. p. 3.

(as he Conjectures) a too Sudden and Copious Irruption of the *Aliment*. This is ſufficiently Provided for in our Subject, by the great ſtreightning of the *Pylorus* here, and the great Aſcent it muſt take, before it can go out; which may be the Reaſon too, of Natures making theſe ſeveral Cells, or Partitions, for the better *Digeſtion* and *Maceration* of the *Food*; for it being *Frugivorous*, Fig. 252. *Graminivorous*, and *Carnivorous* too, the *Stomachs*, are ſo contrived, that as the Firſt here, by its *Inward Pellicle* ſomewhat reſembles that of *Birds*, that are *Carpophagous*, ſo the others, thoſe of *Quadrupeds*.

The *Small Guts*, which in other Animals being faſtened to a large *Meſentery*, uſually do hang down, were here Cloſer gathered, by the ſhortneſs of this *Membrane*, to the *Spine*: and the *Colon*, which in others is ſuſpended, here by its Peculiar ſtructure lies Looſe, and falls down; for the *Duodenum*, ariſing from the *Pylorus* with a ſhort turn, and the other *Small Inteſtines*, made abundance of *Convolutions* and *Windings*. And altho' the *Meſentery* was but very ſhort from the *Spine*, and its Circumference ſeemingly but very little, yet in this Compaſs it contained 27 Foot of theſe *Inteſtines*; for ſo much they meaſured from the *Pylorus* to the *Colon*. The *Colon* was not faſtened to the *Periphery* or *Rim* of the *Meſentery*, as ordinarily: but ariſing from the *Center*, or middle, made a *Spiral Line*, its End hanging looſe, and its turnings cloſely united one to another by *Membranes*. This *Colon* was very large, in reſpect of the other *Guts*; and as I meaſured it, it was 9 Foot long. It had a ſhort *Cæcum*, but pretty Wide, and fill'd with *Faces*. What Dr. *Grew* obſerves, that 'tis peculiar to the Cœcum of a *Hog*, and that of a Horſe, to have the ſame Structure with the *Colon*, is true here too: And it may be reckoned as an *Appendix* of the *Colon*. The *Meſaraick Veſſels* were alſo extraordinary; for here we obſerved a large *Vein* and *Artery*, running a ſmall and equal Diſtance from the *Inteſtines*, and from them ariſing an infinite Number of leſſer, but Straight *Veſſels*, which going Regularly to the *Guts*, and in great Numbers, afforded a very pleaſant Proſpect.

The *Spleen* was about 10 Inches long almoſt, almoſt of the ſame breadth throughout, and in the middle was one Inch and half broad; it was of a Lead-Colour, a little Speckled or Marbled. The Liver conſiſted of 4 large *Lobes*, and was of a dark red Colour; it appeared plainly *Glandulous*; and had no *Veſica ſellea*, but it had a *Ductus Bilarius*, which went from the Liver to the *Duodenum* as uſually. The *Pancreas* was about 5 or 6 Inches long; and was made up of ſeveral *Glands*.

The *Teſtes* were *two Inches* long, larger at the upper end, than the lower, and in the middle, about an Inch broad; they were placed in the *Scrotum*. Their Colour White, their Structure cloſe, ſo that the Veſſels, which compoſed them, did not ſo plainly appear as in an Ordinary *Boar*. Notwithſtanding which, no doubt their whole Compages was *Vaſcular*, tho' here cloſer wrought together, and united. Their Uſe is to Prepare the *Semen*; which is conveyed thence by the *Vaſa Deferentia* to the *Veſiculæ Seminales*.

Theſe *Deferentia* ariſe near the lower part of the *Teſtes*; and are ſo inſerted, that they might alſo equally empty themſelves, either into the *Veſicæ Seminales* or *Urethra*. The *Veſiculæ Seminales* were 1' Inches long, in ſome places ¼; in others half an Inch broad.

Tho' call'd *Veſiculæ*, yet here they appeared more *Glandulous*, nor was their *Cavity* any thing conſiderably large. The common Orifices to them, and the *Vaſa Deferentia*, made a riſing in the Inſide of the *Urethra*; which *de Graef* calls, *Caput Gallinaginis*.

In other Animals at this place, is ſeated that *Glandulous* Body, called the *Proſtata*: But the *Veſiculæ* here being ſo *Glandulous*, poſſibly they may perform their Office; unleſs we ſhould aſcribe their uſe to thoſe two *Glands*, which lay on each ſide the *Urethra*, and emptied themſelves, with two Orifices, near the Root of the *Penis*. Theſe *Glands* were *Cylindrical* of a Whitiſh Yellow *Colour*, an Inch and half long, and ¼ of an Inch in Diameter. Their Subſtance cloſe, like that of the *Teſtes*, and no perceptible *Cavity* within, and they lay along the outſide the *Urethra*, reaching from the *Muſculi Erectores Penis*, to the *Glandulous Veſiculæ* before deſcribed. The *Veſiculæ Seminales* being *Glandulous* muſt therefore ſecrete ſome Juice, which in all likelyhood is ſome ways ſerviceable, tho' not Principally, in *Generation*. The *Penis* was a long ſlender Body; made up of ſeveral *Muſcles* whereof two were very long. The *Veſica Urinaria*, or *Bladder* of *Urine*, was rounder than in ſome other Animals, where uſually 'tis more Oblong. The *Ureters* were inſerted at the Neck of the Bladder, not Sides, as in ſome.

In the *Thorax* we were ſurpriſed at the ſtrange Formation of the *Arteria Aorta*, which as it deſcends along the *Spine*, in all other Animals, I have obſerved its *Trunk* is almoſt of an equal bigneſs, only a little tapering downwards: But here, between the Heart and its Branchings into the *Iliac Arteries*, we found 3 large Swellings out. The largeſt was that neareſt the Heart, which after a ſmall ſtraightning again, emptied it ſelf into the Second; which though ſomething leſs than the Firſt, yet was much larger than the Third, which was near the Diviſion of the *Aorta* into the *Rami Iliaci*. *Two* of theſe Swellings I opened, and found within ſeveral unequal Cells, or Hollows, but withal could not perceive but the *Membranes* here were altogether as thick as where the *Artery* was nothing extended. But this being the only one of the Kind I have diſſected, I know not how far it may be *Præternatural*.

The Aperture of the Eye was but ſmall, as in the *Hog-kind*; the *Membrana Nictitans*, Plainer than uſually in *Quadrupeds*, which might be convenient, ſince wallowing in Mud, they might the better rub off any Filth that might happen there, the *Muſcles* not ſo diſtinct, as in ſome Brutes, and hence the Motion of their Eyes not ſo Quick nor Regular, the Pupil round, the *Optick Nerve* inſerted almoſt in the Axis of the Eye, and on the inſide made a ſmall Dint, the *Choroides* of a *Pale Violet*, and browniſh *Colour*.

Juſt on the Ridge on the Back, over the hinder Legs, is ſeated a *Glandu-*

lous Body, which all Authors call the *Navel*. It is ſo covered by the long *Briſtles* there, that it was not to be obſerved, but by opening of them with the Hand: And then you ſhall find a ſmall Space there almoſt bare; only beſet with fewer, ſhorter and finer Hairs; and in the Middle of it, the protuberant Orifice of the *Gland*, by which it diſcharges it ſelf of the Liquor, which is ſeparated by it within. This Orifice, or Foramen, had its Lips a little Reflected and Protuberant, above the Surface of the Skin. It would eaſily admit of a large Probe, which I could turn into ſeveral Parts of the *Gland*. Upon a gentle Preſſure with my Finger, I could obſerve a ſmall Quantity of a white yellowiſh Juice, and ſome part of it of a little darker Colour; which yielded a very pleaſant and agreeable Scent, and was judged by my ſelf, and ſeveral others who ſmelt it, to be much like that of *Musk* or *Civet*. The *Gland* it ſelf was ſeated between Fig. 25. 1. the Skin, and ſome Part of the *Panniculus carnoſus*: For in the Middle of that Part or Surface, which reſpected the Back, 'twas bare, and not cover'd with that *Muſcle*, but only the Edges of it encloſed within it; ſo that in taking off the Skin, the *Gland* too, as I have obſerved, could not eaſily eſcape, but go with it. However, this Muſcle may be aſſiſting to it, by its Contractions, in preſſing out of its Liquor, as the *Sphincter Muſcle* is to thoſe *Scent Bags*, placed at the Extream of the *Rectum* of other Animals. This *Gland* was *conglomerated*, or made up of ſeveral minute and ſmall white *Glandules*; it had no conſiderable *Cyſtis*, or Cavity within; but like the *Pancreas* or *Salivatory Glands*, it had abundance of *Secretory Ductus*'s, which terminating at laſt in one, diſcharged its ſeparated Juice by a common Orifice.

This *Orifice* having ſomething of a Reſemblance of a *Navel*, has impoſed almoſt upon all who have writ of this Animal, (and have only ſuperficially viewed this Part, without examining any thing further,) to believe it an *Umbilicus*, and thoſe who have deviated from this Sentiment, have been as unhappy, in delivering altogether as abſurd, and extravagant Conjectures about it.

But there is nothing I can parallel this *Gland* with, more than thoſe ſcent Plot's, Nat. Hiſt Oxfordſhire. Bags, or *Scent Glands*, I have formerly mentioned to be in other Animals. This I firſt took notice of in *Polecats*, in which, juſt at the Extream of the *Rectum*, were placed 2 *Bags* fill'd with a *craſſie* and *whitiſh Liquor*, whoſe *Stink* was ſo very great, that I could not well endure the Room, till I had removed them; and then the whole Body ſeem'd very inoffenſive. The ſame I have obſerved in abundance of other Animals; as in all the *Polecat kind*, in our common *Cats*; in a *Lyon*; in *Dogs*; in a *Fox*, *&c.* Thoſe Bags in the *Civet Cat*, or *Hyæna Odorifera* are nothing but the ſame; as are likewiſe thoſe of a *Muſquaſh*, mentioned above: For they are not the *Teſticles* of that Animal, for having ſeen the Skins here in Town, and thoſe *Musk-* Vid. ſupr. §. CVII. *cods*, I find them to be only theſe *Scent-bags*. So the *Caſtoreum* we have in our Shops, is not the Stones of a *Beaver*, as formerly reputed, but of the ſame Nature altogether with our *Scent Bags*. Vid. ſupr. §. CVI.

And indeed in moſt ſpecies of *Animals*, there may be obſerved ſomething the ſame, or analogous to it, which gives them their peculiar *Fœtors*, or *Smells*. Thus I have obſerved in *Reptiles*, as in the *Rattle-ſnake*, in *Vipers*, in our common *Snake*, *&c.* two long Bags in the *Tail*, which empty their fœtid Liquor, near the Verge of the *Rectum*. But in all Animals, I find not theſe Bags or Glands ſeated here, but in ſome, in different parts of the Body: In *Fowl* and *Birds*, in the *Rumps* you will meet with two Glands, which have 3 *Pipes*, or *Secretory Ductus*, ariſing on the Top of it, above the Surface of the Skin, which diſcharges a fœtid Liquor. I find theſe *Glands* the largeſt in *Geeſe* and *Duck Kind*, which uſe the Water; and any one at the Table, by taſting, may perceive in a *Duck* how ſtrong ſcented they be. In *Turkeys* 'tis leſs glandulous, but they have a larger *Cyſtis* within. In the *Oſtridge* indeed, I did not obſerve it on the *Rump*, but ſomething higher on the Back, where it made two Bunchings out, and under the Skin I found a *Cyſtis* fill'd with a concreted yellowiſh *Juice*. This ſomething approached near the Place where was ſeated the *Gland* in our *Mexico-hog*, which I call the *Scent-Gland*, and it yielding ſo grateful a Perfume, (for ſo it was eſteemed by my ſelf, and ſeveral others who ſmelt it) from it, I have named it, the *Mexico Musk-hog*. But this is remarkable; that as our *Musk-hog* has its *Scent Gland* ſeated on the Back, ſo the *Gazela*, or *Musk-Deer*, has his *Musk-bag* on the Belly, near the *Umbilicus*. Every one obſerves what an horrid Stink the Urine of *Cats* will make where it lights; perhaps in rendring their Urine, at the ſame time they may empty their Scent-bags ſeated at the *Rectum*, which mixing with it, in a great Meaſure, may give it its ſtrong *Fætor*. So the ſame of *Rats*, of *Mice*, of a *Fox*, when hunted, *&c.*

No Author indeed has called the Scent of this *Animal* a Perfume; On the contrary, they have all branded it as a Stink: But even the Beſt Perfumes ſometimes make the greateſt Stinks. *Civet*, nay *Musk* it ſelf, when freſh and green, and in large Quantities, are no ways agreeable, but very offenſive to the Smell, as many have obſerved: And what is more too, ſuch as *Ambergreaſe* at the firſt, as *Gull. Piſo* Aſſures us.

Our *Tajacu* therefore, when young, and when but a ſmall Quantity of this Liquor is ſeparated by this Gland, may afford but little or no Scent; and *Foxes*, till they are well Grown, do not much ſtink; but afterwards when in great Plenty, this Juice is voided, by its Copiouſneſs, and being thin and fluid, and ſo more Vapourable, it may ſtrike our Organs with ſuch brisk and nimble Strokes, as to Create a Pain; whereas a more leiſurely Appulſe of its Particles from a leſſer, and concreted Body, may give a Pleaſure. So our *Tajacu*, when this *Gland* does very liberally diſcharge its Liquor, may be thought to ſtink; and yet this Sting in Time may become a Perfume. Thus that fœtid *Liquor* in the Scent-bags of a *Weeſel*, having formerly put it on a Paper, and kept it a little while, afforded me a pleaſant Smell. Why therefore we perceived no Stink at firſt, upon the Diſſection of this *Gland*,[a] but rather a ſweet and pleaſant Smell, (if it is otherwiſe in the Countries, where they breed,) this may be the Reaſon, becauſe it had been dead ſome Days, before I examined this Part, and then I found but a ſmall Quantity of an incraſſated Liquor there; tho' I muſt acknowledge, that I was informed, that when it was alive, it was obſerved by the Family where 'twas kept, that whereever it went it left a good Perfume behind it. This I am ſure of, that when 'twas dead, and obſerved by me, and ſeveral others, it yielded a fragrant one; which I think is ſufficient to juſtify, or at leaſt to excuſe the Name I have given it.

We further obſerved, that the *Cranium* ſeem'd entire, without *Sutures*: From the Noſe to the End of the Pole, $8\frac{1}{2}$ *Inches*. Here the *Cranium* grew very *narrow*, and then did ſpread it. ſelf again *Triangularwiſe*, and behind made a large *Hollow* where it reſpected the Back, and where were inſerted ſtrong *Muſcles*, and the *Ligament* from the *Back*, I formerly mentioned, by which Means the *Head* is kept ſo ſtraight up, that when Alive he ſeemed to have but a very ſhort, if any Neck at all. The *Porus Auditorius*, or *Paſſage* to the Ear, was ſomething *Remarkable*; being placed near the *Pole*. In the *upper Jaw* before were four Teeth, or *Inciſores*, a little further, was placed a large flat Tusk, ſharp Edged, and ſtanding outwards; and beyond that, of each Side, ſix Double Teeth, or *Molares*. The *lower Jaw* was $6\frac{1}{2}$ *Inches* long, $1\frac{1}{2}$ broad at the firſt double Tooth, of which there were 5 of each Side. The Bone of the *lower Jaw* here, from the *Dentes Molares* to the *Inciſores*, ſeem'd ſpongy and curious; and the *Tusks* in this *Jaw*, were Rotted out; as were one or two of the *Inciſores*, which in all were about four.

There were 7 *Vertebræ* of the Neck, which meaſured in Length $4\frac{1}{2}$ *Inches*; The *firſt* or *Atlas*, had two *broad tranſverſe Proceſſes*, but no *Spine*; The *ſecond* had a broad large *Spine*, the 3*d*, 4*th*, 5*th*, had no *Spines*, the 6*th*, and 7*th*, had large Acute ones. There were 19 *Vertebræ* of the Back; the *Spines* of the *firſt*, 2*d*. and 3*d*. were about 3 *Inches* long, but they gradually Decreaſed, as they Approched the *Tail*. The *firſt Vertebra* of the *Os Coccigis*, was 2 *Inches* long, but I thought, that at firſt it might have been ſeveral, though now it was but one Bone There were about 6 *Vertebræ* more, which ran no farther than the Extent of the *Os Iſchii*. There were 14 Ribs of each Side; the *Os Sterni* jutted out about an *Inch* beyond the Setting on of the firſt Ribs. Fig. 249.

The *Scapula* was 5 *Inches* long, the *Os Femoris* of the *Fore-foot*, $5\frac{1}{2}$ *Inches* long; the *Os Tibiæ* of the *Fore foot*, about the ſame Length in the whole; but from the Juncture with the *Os Femoris* to the *Os Metatarſi*, was but 4 *Inches*, for from the Juncture with the *Thigh bone*, it jutted out farther, as in the *Figure*. The *Bones* of the *Tarſus* were 5, of the *Metatarſus* 3, about 2 *Inches* long; the *Bones* of the *Digiti* 9, there being 3 to each Claw, and 3 Claws to each *Fore-foot*. The *Os Femoris* of the hinder Foot, was almoſt 6 *Inches* long; and near its Juncture with the *Os Tibia*, it had a ſmall Bone, like the *Patella* in the *Knee* of a Man. In the Leg here were two Bones; the *Focile Majus* and *Minus*, 5 *Inches* and a half long: But this Part in the Fore-Leg was only a ſingle Bone, though in a Dog, a Monkey, and ſome other Animals, there are two Bones in the Fore Leg likewiſe. The *Os Calcis* was almoſt two Inches long; and there were four other Bones of the *Tarſus* or *Inſtep*. The *Metatarſus*, or *Foot*, was compoſed of 4 Bones; and the two innermoſt much the largeſt, being 2¼ long; there were 4 *Digiti*, and in each 3 *Bones*, whereof the laſt was covered with a Nail.

Explication of the Figures. Fig. 248. Repreſents the natural Shape of this *Mexico-hog*, and the Line *a.* points to the *Scent Gland*.

Fig.248. Fig.249. Fig. 249. The *Sceleton*, *a.* the *Fore Teeth*, *b.* the *Tusk*, *c c.* the *Grinders*, or *Molares*, *d.* the *Lower Jaw*, *e.* that Part of the Lower Jaw which was *Carious*, *f.* the *Cranium*, *g.* the Orbit of the Eye, *h.* the *Porus Auditorius*, or Paſſage to the Ear, *i* the *Triangular Expanſion* of the *Cranium* backwards, *k.* the *Vertebræ* of the Neck, *l l.* the *Vertebræ* of the Back and Loyns, *m.* the *Vertebræ* of the *Os Coccygis*, *n n.* the *Ribs*, *o.* the Protuberant Bone of the *Sternum*, *p.* the *Scapula*, or Shoulder Blade, *q.* the *Os Iſchii*, *r r.* the *Os Femoris*, or Thigh bones, *s.* the *Patella* of the hinder Legs, *t.* the *Tibia* of the Fore Leg, *v.* a large *Protuberance* of the *Tibia*, *w.* the *Tibia*, or *Foſſile majus* of the Hinder Leg, *x.* the *Fibula* or *Foſſile minus* of the *Hinder-Leg*, *y y.* the *Tarſus* or *Inſtep*, on both Legs, *z.* the *Calx*, or *Heel*, in the *Hinder Leg*, *α α α.* the Bones of the *Metatarſus*, or Foot, *β β β.* the *Digiti*, or Toes, *γ γ γ.* the *Nails*.

Fig.250. Fig. 250. The Orifice of the *Scent Gland*, as it naturally appeared on the Outſide of the Skin of the Back: A little Space round this Orifice was almoſt bare of Briſtles.

Fig.251. Fig. 251. The *Scent Gland* it ſelf which was conglomerated.

Fig.252. Fig. 252. Moſt of the *Viſcera*; *a.* the *Oeſophagus*, or Gullet. *b.* the Firſt Ventricle or Stomach. *c.* the 2*d.* Ventricle or Stomach, *d d.* the *Cornua* or Horns of the 2*d.* Stomach. *e.* the 3*d.* Stomach. *f.* the *Pylorus*. *g g g.* the *Inteſtina Tenuia*, or ſmall Guts. *h h h.* the *Colon*. *i.* the *Cæcum*. *k.* the *Rectum*. *l.* the Meſenterey. *m m.* the Meſaraick Veſſels. *n.* the *Pancreas*. *o.* the Spleen. *p.* the Liver. *q.* the *Ductus* of the *Gall*, from the Liver to the *Duodenum*.

Fig.253. Fig. 253. The Outſide of the 3 Stomachs, more in their natural Situation; *a.* the *Gula*. *b.* the firſt Stomach, *c.* the 2*d.* Stomach, *d.* the 3*d.* Stomach. *e.* the *Pylorus*. *f f f.* the Blood Veſſels.

Fig.254. Fig. 254. The *Stomach* opened; *a.* the *Oeſophagus*, or *Gula*. *b.* the Entrance of the *Gula*, or Gullet into the firſt Stomach. *c c.* the Inſide of the firſt Stomach, which was inveſted with a ſtrong, thick, white, Pellicle or Membrane. *d d.* the 2*d.* Stomach, *e e.* the 3*d.* Stomach, in which were remarkable ſeveral *Plicæ* or Folds. *f.* the *Pylorus*.

Fig.255. Fig 255. The *Genital Parts* and the *Bladder*: *a.* the *Bladder* of Urine; *b.* the *Neck* of the *Bladder*. *c c.* the *Ureters*. *d d.* the *Teſtes*, or *Stones*. *e e.* the *Vaſa Deferentia*, *f f.* the *Veſiculæ Seminales*, which here were Glandulous

g. the

the *Caput Gallinaginis*, where the *Veſiculæ ſeminales*, and *Vaſa Deferentia* empty themſelves into the *Urethra*. *h h*. two Glandulous Bodies, which poſſibly may be reckoned the *Proſtata*. *i*. the Orifices, by which theſe glandulous Bodies empty themſelves into the *Urethra*. *k*. the *Urethra* opened. the *Penis*. *m m*. two Muſcles belonging to the *Penis*. *n n*. other Muſcles aſſiſting to the ſame.

Fig. 256. The Heart, and the *Aneuriſmata* of the *Arteria Aorta*, or great *Artery*; *a*. the Heart. *b b*. the Aſcending Branches of the great *Artery*. *c*. the deſcending Trunk of the *great Artery*. *d* the firſt *Aneuriſma* or Diſtention, of the *great Artery* opened, to ſhew its ſeveral Cells within. *e*. a ſtraightning of the *Artery* again. *f*. the 2*d*. *Aneuriſma* opened likewiſe. *g*. the 3*d*. or ſmalleſt *Aneuriſma*. *h h h*. the *Iliac Branches* of the great *Artery*.

Fig. 256.

CIX. This Animal which was brought alive from *Virginia*, has many Names given it by different Authors, and generally, by the *Engliſh*, it is called *Opoſſum*, or *Poſſum*. In *Latin*, it is named *Simi-Vulpa*, and *Vulpi Simia*, as if it were of a middle Nature between a *Fox* and an *Ape*. But I think a Denomination might be beſt given it, from that Particular wherein 'tis moſt diſtinguiſhable from all other Animals; which is that remarkable Pouch, or *Marſupium*, it has in the Belly, into which, upon any Occaſion of Danger, it can receive its young; whence it may properly be named *Marſupiale Americanum*: And I am apt to think it may be reduced to the Vermin Kind.

The Anatomy of an Opoſſum, by Dr. E. Tyſon. n. 239 p. 105

Fig. 257.

It meaſured, from the Extremity of the *Noſe* to the *Tip* of the *Tail*, 31 *Inches*, the length of the *Head* was 6 *Inches*, the *Tail* was one Foot long, the *Neck* and the *Body* was the Complemt of the firſt Dimenſion, the Girth of the *Body* now dead, was 15½ *Inches*; when alive and well, it ſeemed much thicker. The *Fore Legs* were 6 *Inches* long, the *Hinder Legs* but 4½ *Inches*. The Girth of the *Tail*, near the *Root*, was 3 *Inches*; near the Tip but one *Inch*. The Head about the *Ears* was largeſt, meaſuring on the Forehead, from one Ear to the other, 3 *Inches*; thence gradually tapering towards the *Noſe*, and more reſembling that of a *Pig* than a *Fox*. The Aperture of the *Eye lids* were not *Horizontal*, but lying in a ſtrait Line from the Ears to the *Noſe*, and not large. The Ears were about an *Inch* and an half long, not ſharp, but of a roundiſh Figure. The *Rictus* of her Mouth, from the corner, on one ſide, to the End of the Noſe, meaſured 2½ Inches.

The Fore feet had 5 long Claws or Fingers, equally ranging with one another, and a hooked Nail at the End of each Finger. The *Hinder feet* had 4 Fingers armed with hooked Nails, and a perfect *Thumb*, ſet off at a Diſtance from the Range of the other Fingers, and as in a *human Body*, this *Thumb* was ſhorter than the other Fingers, and had not a hooked or curved prominent *Nail*, but a tender flat one. This Contrivance of the Legs, Feet, and Nails, ſeems very advantageous to this *Animal* in climbing up Trees (which it does very nimbly) for preying upon Birds, which it is moſt fond of; tho' it eats other things too. Theſe Fingers, Toes, or Claws were naked, without *Hair*, the Skin looking of a reddiſh Colour here.

They were about an *Inch* long, and the Thumbs almoſt as long. The Palms of all, eſpecially if dilated, as it does in climbing, were large, but ſo contrived, as to be able to be contracted as in Walking: but that they might here be better ſecured from *Injury*, I find at the ſetting on of each Toe, in the Palms, a protuberant, fleſhy and almoſt cartilaginous Body. In Feeding it ſelf, it makes uſe of the Fore-feet in bringing the Food to his Mouth; as do the *Monkey* and *Squirrel-kind*. The *Tail* was without *Hair*, (only for a little way near the ſetting on) and tapering from the *Root* towards the Tip was covered with a Regular Order of ſmall whitiſh Scales; which for the moſt Part were oblongiſh Hexagons, between each of which, one might obſerve a little *Skin* or *Membrane*, in which they are fixed. The Colour of theſe *Scales* makes the Tail to appear Whitiſh, tho' the *Skin* ſeems of a darker Colour.

The Ears were alſo bare, and without *Hair*; And although ſoft and ſlender, and in Colour and Subſtance almoſt reſembling the *Membrane* of a *Bat's Wing*, yet they were erect and of an oval Figure. I could not perceive that cartilaginous Body, which uſually is to be met with in the Structure of this Part, ſo that if it did at all enjoy a *Cartilage*, 'twas at leaſt much finer than in moſt other Animals. The *Concha* or Paſſage to the *Porus Auditorius*, was very capacious. But 'twas obſerved, that when our Subject began to grow ill, the Verge or Rime of the outward *Ear* ſeemed to be crimped; and when it dyed, to be ſo ſhrivell'd, as if burnt up, not making a ſmooth, but a jagged Edge.

The *upper Jaw* was ſomewhat longer than the *under*, the Noſtrils were large, the Eyes black, ſmall, vivid, and exerted, when alive; now dead very much ſunk. The Neck was ſhort, and the Breaſt broad. It had *Muſtachio's* like a *Cat*. The Fur upon the Face was ſhorter and whiter than the reſt of the Body; on the Back and Sides it was of an Aſh Colour or dappel'd with black Hair in ſpots, intermixt with white, eſpecially on the Back; on the Belly 'twas more of an *Amber Colour*, and of a darker on the Legs. The longeſt Hairs, which were ſtronger and courſer than the reſt, meaſured 3 *Inches*; being white towards the Ends, but perhaps the *Fur* may vary in different Subjects.

Fig. 258. At the Bottom of the *Belly*, in the middle, between the two *Hinder Legs*, we obſerved a *Slit* or Aperture, moderately extended about 2 Inches long; capable of a larger Extenſion, by dilating it with ones Fingers, even when it is alive. It can ſo exactly cloſe and contract it, that the Eye does not
Fig. 257. readily diſcover it. On each ſide of this Aperture there is a Reduplication of the *Skin* inwards, which forms a hairy Bag: But the Hairs here are ſo thinly ſet, that almoſt every where you may obſerve the Skin. All Authors agree, that the uſe of this *Bag*, *Pouch* or *Marſupium*, is for the Preſervation of the young Ones, and ſecuring them upon any Occaſion of
Fig. 260. Danger: And the Deſign of *Nature* is admirable in forming and adapting
15. 15. this Part ſo ſuitably to that End. There are two remarkable ſtrong *Bones* not to be met within any other *Skeleton*, which from their Office, I take Leave to call *Oſſa Marſupialia*, or *Janitores Marſupii*. Theſe Bones are ſo faſtened

ſtened to the upper and inward *Edge* of the *Oſſa Pubis*, that at their Baſis *Fig.* 261. ere, they touched one another, juſt at the *Coalitìon* of the *Bones* that form *cc.* e *Oſſa Pubis*; The other Extremes of theſe Bones were ſo diſtant from one nother, that it meaſured 2½ *Inches*. The Baſis of theſe Bones, where joined the *Oſſa Pubis*, was ½ *Inch* broad, having 2 Heads, the larger lying near he Coalition of the *Oſſa Pubis*, and the leſſer towards the *Os Coxendicis*; aving in the Middle a *Sinus*, into which was received a Protuberance of the *ſſa Pubis*. By this Contrivance it appears, there can be no Motion of theſe *ones*, nearer or farther from one another, but that they muſt ſtand always an equal Diſtance: Nor did I, upon Trial, find it otherwiſe, but obſerv'd hey were capable of a ſmall *Motion* inwards, towards the *Spine*, and outwards rom it. Theſe *Bones*, as they aſcended from the *Os Pubis*, grew *Slenderer*, eing about the *Middle* but ¼ of an *Inch* broad: and they were each 2 *Inches* long. To theſe Bones there were beſtowed 4 Pair of *Muſcles*, and here was another Pair that did run over them, to which theſe Bones did erform the Office of a *Trochlea*. The firſt *Pair* of *Muſcles* (*i. e.* which *firſt* ame to be diſſected upon the Pronation of the Animal, and which from s Figure I ſhall call *Triangularis*) ariſes fleſhy from the whole Length of the ternal ſide of theſe Bones, and inſerted their oppoſite *Tendons* on each ſide f the *Rima*, or *Aperture* of the *Marſupium*. Under Part of theſe Muſcles y another, or a 2*d*. Pair, flat and thin, having their Origin from the upper art of the Internal Side of the *Oſſa marſupialia*, and inſerting their oppoſite endons a little above the Tendons of the former Muſcles. The Tenence or Direction of the Muſcular *Fibres* of this Pair, in Relation to the rſt, made a Decuſſation. The third Pair of Muſcles, we ſhall take Notice f, had their Riſe from the Fore-part of the Baſis of theſe Bones where they ere joined to the *Os Pubis*, and were afterwards inſerted into the *Linea ſpera* of the Thigh-bone. The Fourth Pair did ariſe from the external ide of theſe Bones near the Baſis, and are inſerted into the Fore-part of the *high-Bone* near the Middle. The laſt Pair of *Muſcles* ariſes more immeditely from the *Marſupium* or Pouch, it ſelf. For ſpreading their Muſcular ibres all over this Bag, as they iſſue from it, by Joyning their Fibres toether, they more remarkably form a *Solid Muſcle*, which of each Side paſſing over the middle of theſe Bones, (*i. e.* in the Prone Poſture we are diſſecting it) at length were inſerted into the *Spine* of the *Os Ilii*. The two irſt of theſe Muſcles muſt ſerve towards the *Dilation* or opening this Marſupium or Pouch; For theſe Bones are a Fulciment or Baſis; their rticulation will not admit of a Contraction inwards or nearer to one nother, wherefore, when the firſt and ſecond Pair of Muſcles act or ontract, they muſt neceſſarily Open or Dilate the Mouth of the Marupium or Pouch. The third and fourth Pair of theſe Muſcles may ſerve o extend theſe Bones outward; ſo that when this Animal hangs by its *ail*, (as it does frequently) the Weight of the *Fœtus* in this Pouch, by this Means will not preſs ſo much upon the inward *Viſcera*. The Fifth and laſt Pair, as they may ſerve to Dilate the Capacity of the Pouch it ſelf, ſo likewiſe may ſerve the better to ſuſpend its Weight, when the Animal is *prono Capite*; and if it gravitates too much, they may retract it up, and the eaſier, becauſe paſſing over theſe Bones like a Pulley, their *Force* is more Augmented. The *Antagoniſt* to theſe Muſcles is, the *Sphincter marſupii*, an Oval Series of ſtrong Fleſhy Fibres, which ſerve to conſtringe and cloſe the Orifice of the Pouch; which it does ſo perfectly, (as I have already obſerved) that one would think the Skin here not to be ſlit.

Fig. 259. *A.* The *Pouch* or *Marſupium* it ſelf, was a membranous Body, not very thick though conſiſting of ſeveral Coats: And is to be reduced into the Claſs of the Veſiculous Parts of the Body; which according to my Notion are *Part* Muſcles, *Part* Glands; and do perform the Office of both Motion and Secretion. For the Concave or Hollow of this Pouch (as I have remarked) was ſomewhat Hairy, and at ſeveral Places I could obſerve them Matted or Cling'd together by a yellowiſh Subſtance, which did Ouze out of the Cutaneous Glands there; as under the Arm-pits in a Man, it is Obſerved.

This Liquor thus emptied into the Pouch from the Glandulous Coat, I found was ſtrong-ſcented, and had more of the peculiar *Fætor* of this Animal, than any Part beſides: being no Ways grateful, but unpleaſant to the Smell; as has been obſerved of this Creature when alive. But after the Skin with the Pouch had been kept for ſome Days, and was grown dry, I found ſo great an Alteration here in the Smell, that what before was ſo diſagreeable, now was become a perfect *Perfume*, and ſmelt altogether like *Musk*, which made me call to Mind what formerly I had Remarked of theſe *Scent Bags* in other Animals. And I am apt to think that 'twas by Removing this *Marſupium*, rather than taking away the Kidneys, that theſe Animals are made Edible, which otherwiſe ſtink ſo much, that the *Barbarous* Nations Refuſe them, as out of *Lerius*, *Joh. Faber* takes Notice; for I could not ſmell in the *Kidneys*, or Fat about them, any thing ungrateful or ill-ſcented. This *Marſupium* had likewiſe a Muſcular Coat, beſides ſeveral other Muſcles beſtowed upon it, which we have obſerved already that gave it Motion. It had likewiſe a Vaſcular Coat too, being plentifully irrigated with Blood Veſſels; eſpecially by two large *Branches*, that came from the upper Part of the *Thorax*, and might be Reckoned the *Mammaria*, as they are ſtyled in other Animals.

Vid. ſup. §. 168.

This Pouch was faſtened by ſeveral Membranes to the Muſcles of the *Abdomen*, and the Skin, but ſo as I could ſeparate it, for the moſt Part, with my Fingers.

In this *Marſupium*, or Pouch, moſt Authors place the *Mammæ*, or *Teats*; and they tell very odd Stories about it: But upon what Obſervation I could make, I did not find any *Teats* here; nor indeed could I find them in the outward Skin, as is uſual in other multiparous Animals.

Poſſibly this Subject never had a Litter, ſo for want of drawing they might be leſs, ſo as to Eſcape our View. The Male alſo (if we may believe *Piſo*, or the Author of the *Preſent State of his Majeſty's Territories in America*, has ſuch another Purſe under his Belly and takes his *Turn* to carry the Young ones, to eaſe the Female.

This Contrivance of Nature for Securing the Young Ones from any danger, till they are able to ſhift for themſelves, I think is not to be Parallel'd in any *Species* of Animals, at leaſt of the *Quadruped Kind*, beſides.

Oppianus indeed, in his Excellent *Poem* of Fiſhes, tells us of the *Dog-Fiſh*, that upon any Storm, or Danger if purſued, the Young ones run into the *Mothers Belly*, and when the Fright and Danger is over, they come out again; he alſo inſtances the ſame care in the *Squatina* and the *Glaucus*, tho' theſe receive their Young into different Receptacles; but if there be any *Truth* in theſe ſtories, 'tis Requiſite that it were Confirm'd by more Evident Proof and Obſervation. Halieutic. Lib. 1.

In the *Thorax* of the *Poſſum*, I obſerved that the Lungs had 3 *Lobes* on one ſide, and but one on the other; But this One was as large as the other *Three*. They were Soft and Spongy, and eaſily Dilated; and large, proportionably to the Animal. The Heart was included in a *Pericardium*, as uſual; but the Heart it ſelf I thought proportionably larger, in reſpect to the bulk of the Body, than is commonly, nor was it's Cone ſo ſharp, but rather more Obtuſe. It had two *Auricles*, and two *Ventricles*. About the *Throat* there were large *Glandulæ Maxillares*, the *Tongue* was a little above 3 Inches long, and about ½ of an Inch broad; 'twas Rough, having Protuberances whoſe Points looked inwards; the Voice, or Noiſe it made, was a little Growling.

The *Abdomen*, or *Belly*, was divided from the *Thorax*, or *Breaſt*, by a large, ſtrong, fleſhy *Diaphragm*: For the Compaſs of the *Thorax* in this place was very great and large, which might be rendered ſo the more, by Reaſon it often hangs by it's *Tail*, and when it does ſo, the *Viſcera* in the *Abdomen* can't but Preſs upon it.

The *Ventricle* or *Stomach* ſomething reſembled the Figure of a *Half Moon* as uſually: but the two Orifices of the *Gula* and *Pylorus* were placed ſo near one another, that they ſeemed to touch or meet; and when I opened the *Stomach*, I found only a very ſlender *Iſthmus*, or *Wall*, parted them. Theſe Orifices were inſerted almoſt in the middle of the upward part, but more inclining towards that, that reſpects the *Duodenum*. It appeared but ſmall being much contracted; for it had not eaten any thing for ſome Days; it meaſured about 3½ Inches in length, and about 2 Inches in Depth. The *Gula*, which conveys the Food into the *Stomach*, conſiſted of ſtrong *Muſcular* Fibres, and was in all about 9 Inches in length. The *Pylorus*, that carries out, ſeem'd to have its Paſſage free and open, without that *Annular Conſtriction*, or *Valve*, as in moſt other Animals; though here we obſerved a larger Body of Muſcular Fibres, than in other Inteſtines. Fig. 263.BB.

At

Fig. 263. C. At one ſide I obſerved a *Perforation*, or Hole through, about the bigneſs of an ordinary Pea, and round. That this was occaſioned by an *Ulcer* there, I plainly perceived by the Lips or Edges, which were not freſh, but had an *Ulcerated* Matter about them; and this, without doubt, was the Occaſion of its Death; for it had fallen from its Food, and had Pined away for ſome Time before, and by its uneaſie Motion, made its keeper ſuſpect, it had ſwallowed ſomething that ſtuck in its Throat, or injured its *Stomach*. A like Accident I have three times met with in the Diſſection of *Human Bodies*. Perhaps ſome of the *Glands* in the *Stomach* (ſuch as *Payerus* and Dr. *Grew* deſcribe in the *Inteſtines*) being become *Scrophulous*, or *Steatomatous*, might *Impoſtumate*, and ſo *Corrode* the *Coats* of the *Stomach*, and Cauſe this *Perforation*: And the rather I am of this Opinion, becauſe I found, in other Places of the *Stomach*, theſe *Glands* very large and *Steatomatous*; tho' naturally they are but ſmall, and often not obſerved. Where there is a *Perforation* of the *Stomach* upon an *Inflammation*, and upon that an *Impoſthumation*, there the *Foramen* is larger and not regular; as remarkably I once met with it in a Child, where a larger part of one ſide of the *Stomach* was *Sphacelated*. So likewiſe upon a *Corroſive Poiſon* taken, its Effect dilates it ſelf more, and is not confined to ſo narrow a Compaſs, as I obſerved once in one who had taken *Rats-Bane*.

e Glandul Inteſtin.

Comparative Anat. of the Stomach and Guts.

Fig. 266. There was nothing contained in the *Stomach*, but a Body of *Clotted Hair*, formed into the Shape and Figure of the *Stomach*, ſomewhat like an *Half-Moon*; covered with a Slimy *Viſcid* Subſtance, which did ſerve the better to glue theſe *Hairs* together. Theſe *Hairy Tophi* are frequently to be met with in the *Stomachs* of *Oxen*; and the *Butchers* inform me, that they chiefly meet with them in the Winter Seaſon, after the *Hair* begins to ſhed, and the Cattle feed upon Hay or dry Meat; but after the Spring, and in Summer, they do more ſeldom find them; as if the *New-Graſs*, which Purges them, did contribute to Diſſolve theſe *Tophi* likewiſe. But our Animal is *Carnivorous* and (in which all Accunts agree) moſt *Rapacious* of the *Winged Kind*; and where it can't find its Prey on the Land, it will hunt for it in the Trees, moſt nimbly Climbing them up; and if the tender Bough cannot Bear the Weight of its Body on its Feet, by twiſting its Tail about the Twig, it can hang thereby, and ſtretch it ſelf the farther, to obtain its deſired Food, or rob a Neſt. Nay, if I am not miſinformed, by this means it can Fly, or paſs from one Tree to another, without deſcending down; for thus hanging by its Tail, and Waving and Swinging its Body like a *Pendulum* it can fling it ſelf into the Boughs of a Neighbouring *Tree*, where his Tail is ſure to take faſt hold of the firſt Bough it lights on, if otherwiſe it miſſes its Footing; and, as I have ſhewn, his hinder Legs being made like Hands, with a Thumb, it can more readily raiſe its Body up by them. But tho' theſe Animals be *Carnivorous*, yet when *Need drives* them, they can take up with other Food; for this we diſſected would Eat any thing that was brought from the Table.

The *Meſentery* is that *Membranous* Part, which Colligates the *Inteſtines*, and fixes their Situation, and gives to them the Order of their Figure. *Fig.* 263. For the *Inteſtines* are not juſt faſtened to the *Peripherie*, or outward Circumference of the *Meſenterie*; but the outward *Membrane* of the *Meſenterie* of both ſides, is entirely Projected and continued over the whole *Canalis*, or *Duct* of the *Guts*; and is to them the outward or common *Membrane*. So that often, by ſeparating this outward *Membrane* from what lies under it, the *Muſcular*, I have Extracted the whole length of the *Guts*, leaving only the common *Membrane*, as 'tis continued from that of the *Meſenterie*; which I could Inflate, as if the whole of the *Guts* remained. Now here we obſerved that Remarkable Difference from what is in many other Animals, that we cannot but make two *Meſenteries*: one peculiar to the ſmall Guts, the other belonging to the great Ones.

The former I ſhall call *Meſenterium Minorum*, and the latter *Meſenterium Majorum Inteſtinorum*: For as the *Duodenum* deſcended from the Stomach, it ran under the *Colon* (juſt where 'tis joined to the *Cæcum*) towards the middle of the *Spine*. Hence I found a *Projection* of the firſt *Meſenterie* into a Spiral Line, like a *Cochlea* or Winding Pair of Stairs: So that upon *Inflation*, theſe *Inteſtines* here made ſeveral *Convolutions*, tho' not exactly *Spiral*. The ſecond *Meſenterie* was Proiected more in a Plain; and made almoſt a Circular Figure at its Peripherie: So that the *Cæcum*, and *Colon*, did almoſt entirely Encircle the ſmall Guts.

The Reverſe of this Structure of the *Inteſtines* I formerly found in the Anatomy of the *Tajacu*, for there the *Colon* made a *Spiral* Figure, and the ſmall Guts made a Plain. *Vid. Sup.* §. CVIII. But this *Spiral Convolution*, of the *Inteſtines* is alſo to be met with in ſeveral other Animals, though their Structure be different; as in the *Goat* and *Deer kind*; and very remarkably in a *Wood-Cock*.

The ſmall *Guts* meaſured about 6½ Feet in length; the *Cæcum* was about 6 Inches long; and the *Colon* and *Rectum* 2 Foot long. The Girth of the *Duodenum* (I mean all along here as Inflated) was 3 Inches; the *Ileon* 2½ Inches; the Girth of the *Cæcum* in the largeſt place, was 6 Inches; of the *Colon* 4 Inches: And the *Rectum* was 3 Inches about. From the *Spine* to the utmoſt Projection of the ſmall *Guts*, (under the ſame Circumſtance of Inflation) we meaſured about 6 Inches, the greateſt Diameter that the *Colon* in this Circular Figure made was ſomewhat above 7 Inches. In the whole *Duct* or *Canalis* of the *Inteſtines*, I could not obſerve any *Valves*, no not at the *Cæcum* it ſelf. 'Tis True, that the *Foramen* into the *Cæcum*, was a great deal leſs than the Capacity of the *Gut* it ſelf: However the Paſſage into it was ſo open and wide, as readily to Receive or Emit its Contents.

But the Length and frequent *Gyrations* and *Windings* of the *Inteſtines* ſupply this want of *Valves*; they prevent the Danger of a too haſty Deſcent of the *Fæces*, and gave a greater Opportunity to the Separation of the *Chyle* into the *Vaſa Chylifera*. And the *Cochlea* or *Spiral Figure* of the *Firſt*

Meſentery eaſily Prevents the *Regurgitation* of the *Contents* of the *Inteſtines* again into the Stomach, upon a *Declivity* of the Body of this Animal, as it is frequently in, when it hangs by its *Tail*. For tho', as I obſerved, the Paſſage from the Stomach, by the *Pylorus* into the *Duodenum*, is large and open, yet in the Poſture of the Body, there cannot but be a *Reduplication*, or folding over of the *Duodenum*; ſince the great Bulk or Wallet of theſe *Inteſtines* muſt incline and Swag towards the *Diaphragm*: by which *Reduplication*, the Paſſage at the *Pylorus* muſt, in a great Meaſure, be Occluded; and the *Aſcent* of the *Contents* now, be altogether as difficult and great, as when the Animal ſtands upon its 4 Feet.

Fig.267BBB The *Pancreas* was large, having one part (if I miſremember not) running towards the *Spleen*, and the other down by the *Duodenum*. The *Liver* was very large, of a *Bright Red* Colour, conſiſting of 3 *Lobes*; two of them were much larger than the third, which was not to be ſeen, but upon inverting the *Liver*. And here we found not only at the Edges of one of the larger *Lobes*, deep *Inciſures*, which rendered it *Jagged*; but alſo in the middle of the Concave part of the ſame *Lobe*, ſeveral deep *Fiſſures*; poſſibly for this Reaſon, that ſo it might yield and give may the better, when 'tis inverted, as 'tis always, when this Animal hangs by its *Tail*. The *Bladder* of *Gall* was very large. The *Kidneys* of each ſide were a little above an Inch Fig.264 AA and half long, about ¾ of an Inch broad, and of the Figure almoſt of a *Kidney Bean*. The *Emulgent veins* and *Arteries* were very plainly Seen: But on inſide of the *Kidneys*, towards the upper part, were placed the *Glandulæ Renales*, which were very large and of the ſame Colour with the *Kidneys* themſelves, which was a deep Red.

Fig. 264. f. The *Vreters* were about 5½ Inches long, and were Inſerted into the Neck of the *Bladder* of *Vrine*, as is repreſented, firſt running under, then Aſcending up by the two Extreams of each *Vterus*, as they lie Duplicated. The *Bladder* of *Vrine*, being Inflated, was about the bigneſs of a *Hen's Egg* and of that Figure. The *Neck* of the *Bladder*, or *Vrethra*, (which was about an Inch long) lay over the *Vagina Vteri*: and here the *Vrethra* and the *vagina Vteri* Emptied themſelves into one *Common Canalis* or *Paſſage*, which meaſured about an Inch and half in length. In moſt Animals, about the *Kidneys* there uſes to be obſerved a large Body of Fat Covering them, being contained in the *Membrana Adipoſa*: But here we found 4 large *Protuberant Lumps* of Fat, two of each ſide; two of them lying in the *Pelvis* of the *Abdomen*, near the *Bladder* of *Vrine*, and the *Vterine Parts*, and the two others, between them and the *Kidneys*.

They conſiſted of Regular large *Laminæ*; which were eaſily Separable from one another, in broad Flakes, ſo as I have never obſerved before.

Fig.264,265 Amongſt the *Vterine Parts*, which were very ſurpriſing, we found *Two Ovaria*, *Two Tubæ Fallopianæ*, *Two Cornua Vteri*, *Two Vteri*, and *Two vaginæ Vteri*. The *Ovaria* were placed one of each ſide near the Extreams of the *Cornua Vteri*, being faſtened to the *Alæ Vteri*; and were about the bigneſs of a vetch. The *vaſa Præparantia* (the *Artery* and the *Vein* that did go to and from them) were very plain, and as I have repreſented them; though the greateſt part of theſe *Veſſels* were beſtowed upon the *Cornua Vteri.* Near the *Ovaria*, I obſerved the *Fimbria Foliacea*, and thence a Paſſage into the *Tuba Fallopiana.* Fig. 264. The *Tuba Fallopiana* were two fine ſlender *Canales* or *Ducts*, ſupported by nnn. oooo. the *Ala Vteri* and running waving, and led into the Extreams of the *Cornua Vteri.* The *Cornua Vteri*, being inflated, were about the bigneſs of a *Gooſe Quill*, about an Inch and half long; and were faſtened to the *Ala Vteri*, towards both ends a little Crooked, but where they paſs into the *Vteri*, they were reflected Inwards, and at the other Extream Reflected outwards. Their Subſtance ſeemed rather thicker then the *Vteri* themſelves, and not ſo Tranſparent, by Reaſon of the numerous *Blood Veſſels* which irrigated them almoſt all over; for in the inſide, both above and under, there ran the whole length of the *Cornua*, large *Trunks* of *Blood-Veſſels*, ſending from the ſides all along Numerous Branches, which is very Requiſite: For in Animals that are *Multiparous* as is our Subject, (having 5 or 6 Young ones at a time) the *Litter* or *Fœtus* do lie, and are Formed in the *Cornua Vteri.* And I did here take notice of ſome little Riſings of the inward *Membrane* of the *Cornua*, whereby they were ſomewhat divided into Cells, but very imperfectly. However for the Nouriſhment and Formation of the *Embrio*'s here, ſo great a Number of *Blood Veſſels* is highly neceſſary, and they were far more Numerous here than in the *Vteri* themſelves. Theſe two *Cornua* do Empty themſelves into the *two Vteri*, juſt in the middle Fig. 264. xx where they are Conjoined together, and ſo outwardly ſeem to form, but Fig. 265. oo as it were one continued Body. In *Lobſters* and *Crabs*, in the Female there Vid. Sup. are *two Vteri*, as in the Male there are *two Penes*; ſo *two Penes*, and each §. XLIII. Forked too, I have obſerved in the *Rattle Snake*: But I think this is the only Inſtance of a *Land Quadruped*, that has *two Vteri*; and each of theſe too, ſeemingly double by the *Reflection* they make, and by an Imperfect *Diaphragm*, which divides the Cavity of each *Vterus* a conſiderable way.

Theſe *Vteri* are not faſtened to the *Ala*, as are the *Ovaria*, *Tuba* and *Cornua*; but where they are Conjoined near the Inſertion of the *Cornua*, they do Adhere very firmly to the Neck of the *Bladder*, not eaſily to be ſeparated thence; and by a *Membrane*, to the *Rectum*, where they are more ſeparable. So that the Neck of the Bladder lies over the *Diaphragm*, or *Membrane*, which parted them (as I ſaid) into two Diſtinct *Vteri.* Here the Body of the *Vteri* meaſur'd in Compaſs (thus Inflated) was about 1¾ Inch: Hence they were Projected towards each ſide, and not according to the length of the *Spine*, gradually inlarging the inward Cavity, as 'tis extended; for here about the Angle of *Reflection*, if meaſur'd in Compaſs 2 Inches and an half. The *Vteri* being thus extended towards each ſide about the ſpace of 1¾ Inch, are then Reflected back again towards the *Neck* of the *Bladder*, and ſo paſs into the *two Vagina* which lie under the *Vrethra.* From this Angle of Reflection, the Cavity of each *Vterus* gradually Leſſens, and is much ſmaller than the other parts of the *Vterus*; the Capacity of each *Vterus* being the largeſt at the outward Elbow, where it begins to be Reflected, for here it was made, as 'twere, one Common Cavity for almoſt the length of an Inch. But on the inſide, I obſerved a *Membran* to be Projected from the Internal ſide of the *Uteri*, juſt from the Corner where the ſides of the *Uteri* are *Doubled*, whereby this Cavity is in part divided; and for this Reaſon, ſhall call this *Membrane*, the *Second*, or an *Imperfect Diaphragm* of the *Uteri*. In theſe *Uteri* I obſerved four large *Trunks* of *Blood Veſſels*, which did run the whole length of them, ſending from their ſides Numerous *Branches* and *Ramifications* all along. Theſe *Trunks* were Propagated from the *Hypogaſtrick* and *Spermatick Veſſels*. I did alſo here obſerve in theſe *Uteri* (this by *Inflation* extended and dried) ſeveral *Faſciculi* of *Muſcular Fibres*, placed at a Regular Diſtance from one another; which did run the whole length of the *Uteri* likewiſe: By means of whoſe *Contraction*, the *Fœtus* may be more eaſily forced out.

Theſe two *Uteri* Empty themſelves into the two *Vaginæ*; for at this Extream, the *Uteri* making a *Turn* at the *Neck* of the *Bladder*, are continued thence into the two *Vaginæ*, which lie juſt under the *Urethra* and are much of the ſame length with it, which was about an *Inch*. Their Capacity was about the bigneſs of a *Wheat-Straw*: Both theſe *Vaginæ*, and *Urethra* too, Emptied themſelves into a *Common Paſſage*, or *Canalis*, which was as large as all the other three, and about 1½ *Inch* long. It looked Reddiſh by means of the Numerous *Blood Veſſels* it enjoyed, and at laſt had its Exit ſo near the *Fundament*, that when alive, there was not obſerved any other *Foramen* outwardly, but that which led into the *Rectum*: But when I came to Diſſect it, by Elevating the Skin here, which ſeemed to cover it, like a *Valve*, I obſerved the *Foramen* that led into this *Common Paſſage*, and putting a Blow Pipe into it, at the ſame time, by *Inflation*, I extended the *Bladder* of *Urine*, and the *Uterine Parts* too, *viz.* The *Vagina*, the *Uteri*, and the *Cornua*. So that in the Skin here, there was only one *Foramen* for the Exit of the *Fæces*, and the *Urine* and the *Fœtus* too.

I have not had an Opportunity of Diſſecting a *Male Poſſum*; and the Account we find of it in Authors is very Short and Imperfect, ſo that Mr. *Ray*, with good Reaſon, Queries whether the *Tai ibi* of *Brazile*, deſcribed by *Margrave*, differs from our Subject, the *Poſſum*, only in Sex.

The *Skeleton* of the *Head*, from the End of the *Occiput*, to the Extream of the *Nares*, was 4 *Inches* and ½ long, of which the *Roſtrum* meaſured 3 *Inches*, and juſt where the *Roſtrum* and the *Cranium* met, the *Bones* were ſo Pinched in at the ſides, that here 'twas very narrow; and I may ſay, in proportion to the Bulk of the Animal, this was the leaſt *Cranium* I ever met with in a *Quadruped*. On the *Forehead*, the *Roſtrum* was an *Inch* broad, having on each ſide a Protuberance jetting out. There was a large *Sutura* juſt in the middle, which divided the upper Bones of the *Nares* lengthways; and though they run ſlender towards the Extream of the *Nares*, yet theſe Bones towards the Forehead, ſpread into a Triangular Figure, and as they are jointed together, they form a *Rhomboide*, or a *Lozinge*. There was a Remarkable Riſing Ridge like a *Creſt*, that runs the length of the *Cranium*, from the *Forehead* to the *Occiput*, juſt in the middle, where the *Sutura Se-*

gittalis

ttalis is in other *Skulls*. This Ridge, for Diſtinction ſake, I ſhall call, *Proberantia Oſſea Longitudinalis*; and I obſerved, it jutted out from the *Cranim*, above a Quarter of an Inch. Juſt at its upper Edge, I could perceive a *eam* like a *Suture*: So that though now, theſe Bones are ſo well united toether, that they appeared as one entire Body, yet in the *Fœtus*, without oubt, t[illegible]y are ſeparable, and are two; and this I rather think, becauſe the upper part of the *Cranium* I could not find any *Sutures* at all. So kewiſe anſwerable to the *Lambdoidal Suture*, may be thoſe other *Ridges* in the xtream of the *Occiput*, which I ſhall call, *Protuberantia Oſſea Laterales*: Vhich ariſing on each ſide from the *Proceſſus Styloides* aſcend oblique up the inder part of the *Occiput*, and juſt in the middle in the top, are joyned ith the *Longitudinal Ridge*, I have deſcribed. Theſe *Ridges*, although as eep as the firſt, yet were not ſtanding ſo upright, but Projected rather like *Pent-Houſe*, over this hinder part of the *Cranium*: By both which *Ridges*, he *Cranium* is ſo well Guarded and Defended, that 'tis almoſt impoſſible, he *Skull* ſhould be any ways Cracked or Broken. Something like theſe *Rides*, but nothing ſo large, I have obſerved in the *Skull* of a *Weaſel*. The *Eyes* ikewiſe are very well Guarded, and Defended, by the *Os Zygomaticum*; which s very broad and ſtrong, in the broadeſt place being above ¾ of an *Inch*, and n the narroweſt half an *Inch*, being very thick on its under Edge; but at ts upper, growing thin and ſharp. But for the greater ſtrengthning this one, (which is formed by a *Proceſs* from the *Os Temporum*, and another from he *Maxilla Superior*) where they meet they lap over one another, and ſo ecome the Stronger. This *Os Zygomaticum* was 2½ *Inches* long, and ſtandng off from the *Cranium* an *Inch* in diſtance. In the *Orbit* of the *Eye*, at the *nward Canthus*, there was a large *Foramen*, which led into the Cavity of the Noſe; and by a Duct placed here, the Tears, or Moiſture from the Eyes, s conveyed into the Noſtrils. In the upper Jaw Bone likewiſe, there was large *Foramen*, which was for the Paſſage of ſome *Veſſels* from the inward *rbit* of the Eye. The *Cranium*, which encompaſſed the Brain, in the largeſt place, was about an *Inch* over, and about an *Inch* and half in length; ut its Cavity jutted out ſomewhat farther towards the *Nares*, making as t were, a particular Cell here, and pretty Capacious, for the receiving the *Proceſſus Mammillares*, and that Fore-part of the Brain. And afterwards I obſerved the *Os Cribriforme*, very remarkably Perforated with Holes like a Sieve; and indeed in Forming this *Organ* of Smelling, nature ſeems very Careful, and Solicitous, the *Roſtrum* making ſo great a part of the Head, that the *Cranium* it ſelf ſeemed very inconſiderable in Reſpect to it, its inward Capacity containing not above the Quantity of a *Walnut*, The *Os Spongioſum* in each *Noſtril*, ſeemed very Curiouſly contrived, by the abundance of *Lamina* it enjoys, ſo that the *Membrane* that covers them, by this means, s rendered more Capacious, and Capable of receiving more plentifully the *Effluvia*'s of thoſe Animals, it would either Catch, or Avoid, and in this *Senſory* 'tis known that *Brutes* excel even Man himſelf, and their *Organ* is more Adapted for it.

The under *Jaw* conſiſted of two ſtrong *Bones*, joyned together only at the *Mentum*, each meaſured 4 *Inches* in length. The Head of this Bone (which was half an *Inch* broad) was received into a *Sinus* of the *Os Temporum*, and very firmly *Articulated* there. It had two *Proceſſus*, the *Anterior* or *Superior* is large and thin, into which is inſerted the *Temporal Muſcle*: The *Inferior Proceſſus* is ſmaller, and runs to a ſharp Point. Here at this *Proceſs*, the Edge of the *Mandible* is ſo Dilated, that it meaſured above half an *Inch*. On the inſide of the *Jaw* there is a large *Sinus*, which leads to a *Foramen* that goes into the Body of the *Jaw Bone*, and affords a Paſſage for the *Veſſels* thither. In the upper *Jaw* before were 8 ſmall *Dentes Inciſores*, 4 of each ſide; then a *Void Space*, almoſt a quarter of an *Inch*, then two large Prominent *Dentes Canini*, one of each ſide, which Jutted out of the *Jaw* about half an *Inch*, theſe were ſucceeded on each ſide, with 3 *Dentes Inciſores*: but theſe were much ſtronger and larger than the *Fore-teeth*, and imitated the *Dentes Molares*, were *Flat* and almoſt of a *Triangular* Figure; there were 4 *Dentes Molares* on each ſide, in all 24 *Teeth* in the upper *Jaw*. But the *Double Phangs* of the *Molares* and the *Inciſores Majores*, were ſuch as at firſt Sight, one would think them two Diſtinct *Teeth*, each *Phang* being inſerted into a Diſtinct *Alveolus*, or *Socket*, in the *Jaw*, and remaining ſeparated ſome Way above the *Jaw-Bone*, and only joyned at the Head. In the *under Jaw Bone*, there were likewiſe of each ſide, 4 *Dentes Inciſores Minores* before, then a little *Void Space*, after that, the *Dens Caninus*, then 3 *Dentes Inciſores Majores*, and laſt of all 4 *Dentes Molares*, anſwerable to thoſe in the upper *Jaw*, but ſomewhat ſmaller. In both *Jaws*, in all 48 *Teeth*.

There were 7 *Vertebræ* of the *Neck*, 13 of the Back or *Thorax*, 6 of the *Loins*, 3 of the *Os Sacrum*, and 22 of the *Tail*, 51 in all. The *Firſt Vertebra*
Fig. 268. of the Neck (to which the Head is faſtened, and is therefore call'd the *Atlas*) had *two* Broad Tranſverſe *Proceſſes*, but no *Spine*. The 2*d*. *Vertebra* of the Neck had a very large and thick *Spine* of a Triangular Figure: and in it was obſerved a large Semi-circular *Sinus*, which was ſo deep as to recei
into its Boſom a great part of the *Firſt Vertebra*, by which means the *Articu-*
Fig. 368. d. *lation* was very much ſtrengthned. This *Vertebra* is called *Dentata*, fro
that *Tooth-like Protuberance* I have repreſented, and which is receiv'd in
the Hollow of the *Firſt Vertebra*, where the *Medulla Spinalis* runs. T
Vertebra backwards, had two *Proceſſus obliqui Superiores*, and two *Obliqui In-*
Fig. 269. *feriores*. The 3*d*. *Vertebra* of the *Neck*, had the ſame *Proceſſes* both befo
and behind, but the *Spine* here was about 3 quarters of an *Inch* in height, a-
bout the 3*d*. part of an *Inch* thick, and juſt at the top ſeemed to be a litt
Cleft. The 4*th* and 5*th Vertebræ* had the ſame *Proceſſes*, as the 3*d*. *Vertebra*, a
the *Spine* here likewiſe was very thick and Cleft at the top, but graduall
leſſening in height, as alſo thickning. The 6*th*, *Vertebra*, beſides the for-
mer *Proceſſes*, had likewiſe an *Acute Tranſverſe* one on each ſide, and its *Spi*
much ſhorter and more *Acuminated* than the former. The 7*th Verte*
of the Neck had only two *Oblique Proceſſes* before and none behind, and t
Acute Tranſverſe Proceſſes, and a very ſhort and ſharp *Spine*: So that upon hol
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ing up the *Head*, the *Spine* of the *firſt Vertebra* of the *Thorax* would touch the top of the 5th *Vertebra* of the *Neck*. Theſe *Vertebra* are ſo ſtrongly and cloſely locked into one another, that tho' each of them are large in themſelves; yet thus articulated, they do not make full 2 *Inches* in length. This thickneſs and Strength of the *Vertebra* of the *Neck*, and likewiſe of ſeveral of the *Vertebra* of the *Thorax* and *Loyns*, and the prominent bony Ridge in the *Cranium*, ſo well ſecure his Neck, Back, and Head, that ſhould it happen to fall to the Ground, there would be no Danger of breaking any of them.

The firſt 7 *Vertebra* of the *Thorax*, have 2 *oblique Proceſſes* forwards, which *Fig.* 270. run under the hinder *Oblique Proceſſes* of the preceeding *Vertebra*, and have *two oblique Proceſſes* backwards, which ride over thoſe of the ſucceeding *Vertebra*; as likewiſe *two tranſverſe Proceſſes*, which at their Ends have ſmall *Acetabula's* or *Sinus's*, for the receiving the Heads of the Ribs, which are faſtened to them. The *Spines* of theſe *Vertebra* are ſlender, thin and ſharp, about ¾ of an *Inch* long. The 6 following *Vertebra* of the *Thorax*, have ſhort, thick, and flat *Spines*, the *oblique Proceſſes* being continued on each Side of the *Spine*, make, as 'twere, a *Gutter*; and the *tranſverſe Proceſſes* here, are ſomewhat different from the former. The *Spines* of the *Vertebra* of the Back, or *Loyns*, the more they approached the *Os ſacrum*, ſo they leſſened gradually in *Fig.* 271. their Thickneſs on the Edge. But here were double oblique Proceſſes, *viz.* 4 at each end of the *Vertebra*, and the undermoſt ſpreading themſelves out broad. The 3 *Vertebra* of the *Os ſacrum*, are firmly faſtened to the *Os Ilium*, but the laſt not ſo entirely as the two former. But this at each ſide had a broad *tranſverſe Proceſs*, and the *Spines* of theſe were thin, the two firſt Vertebræ of the Tail had only one ſmall *acute Spine*, but in all the other Vertebræ of the *Tail*, both at the *Head* and *Tail* of each *Vertebra*, I obſerved two *Spines* but thoſe at the Head of the Joint, the larger. In the 6 firſt Vertebræ of the *Tail*, there was, on each Side, a broad tranverſe Proceſs, the length of the Joint; In the other Vertebræ, only at the Head and Tail, a Jutting out at the ſides. The Vertebræ about the middle of the Tail, were the longeſt; being there about an Inch long; near the Root of the *Tail*, and at the End, not ſo long

Fig. 272. The *Spines* or *Hooks* placed in a Line in the Middle of the Underſide of the *Vertebra* of the *Tail*, are a wonderful Piece of Nature's *Mechaniſm*. 'Tis true, the firſt 3 *Vertebra* had none of theſe *Spines*, but in all the reſt, they were to be obſerved; but as they approached the extremity of the Tail, they grew leſſer and ſhorter; theſe Spines, where longeſt, were about ¼ of an Inch, or ſomewhat more. They were placed juſt at the *Articulation* of each Joint, and in the middle from the Sides, and ſeemed to be articulated, both to the preceeding and following *Vertebra*, not being an entire ſolid Body, but ariſing from the Vertebræ with two Legs or *Crura*, become afterwards perfectly united at the Ends. By this means, the Bones are rendered more firm and ſtrong, and this *Hollow* ſerves for the tranſmitting of the Blood-Veſſels thro' them; and one may obſerve here a *Stria*, or *Furrow*, all the Length of the *Vertebra*, for the receiving them, whereby they are the better ſecured from Compreſſion, when this Animal hangs by its Tail. And for the performing this Office, nothing, I think, could be more advantageouſly contrived; For when the *Tail* is twirled or wound about a Stick, this *Hook* of the *Spine* eaſily ſuſtains the Weight, and there is but little Labour of the *Muſcles* required; only enough for the Bowing or Crooking the *Tail*; for then, as by a *Hook*, the Weight of the whole Body is hereby ſuſpended. And for the doing this, 'twas obſerved, that in each preceeding *Vertebra*, there did a *Muſcle* ariſe, which was inſerted on each Side of the ſucceeding *Vertebra*; which *Acting* or *Contracting*, muſt neceſſarily bend and curve that Joint. But for the ſtrengthning the whole, there were obſerved 4 *Muſcles* to ariſe from the *Os ſacrum*, which did run the whole length of the *Tail*; two on the upper ſide and two on the under; ſending each a Tendon to each *Internode* or *Vertebra*. So that when the Skin was ſtript off, the outward Parts of theſe *Muſcles* ſeemed to have tendinous Expanſions over them, the whole length of the *Tail*, and almoſt to be covered by them, which muſt needs very much contribute and add Strength to the *Tail*; beſides what may be the Effect of their Inſertion of *Tendons* into each Joint, or *Vertebra*, in *curling* and *unbending* the *Tail*.

To the *Vertebra* of the *Thorax* are faſtened the *Ribs*, and there are 13 on each Side. The 7 Foremoſt are more perfectly *articulated* with the *Sternum*, Fig. 266. the 6 ſucceeding, may be reckoned in ſome ſenſe, *Coſta Notha*: For though they are long, and as they proceed from the *Vertebra*, are inclined *backwards* towards the hinder Legs, yet afterwards they are reflected forwards towards the *Sternum* or *Cartilago ſcutiformis*. And tho' in other Animals, that Part of the Ribs that is faſtened to the *Os Pectoris*, or *Sternum*, be uſually *Cartilaginous*, yet here, in our Subject, I obſerved it to be all *Bony* throughout. However, this Difference I found, that the *Ribs* did look *redder*, by Reaſon of the Blood Veſſels in them, and this Part was *Whiter*, as where it was faſtened to the Ribs, one might plainly ſee; ſo that it may well paſs for a *Bony Cartilage*, as often the *Cartilages* do become Bony.

The *firſt Rib* was only an *Inch* long, and its *bony Cartilage* a *quarter* of an *Inch*: Hence gradually the *Ribs* increaſe in length, for the *7th Rib* was 3 Inches long, and its *Cartilage* was one Inch and a half. The 4 laſt of the *Coſta Notha*, gradually leſſen again in length, for the laſt Rib of all was only one Inch and ¾ long; and its *Cartilage* did not run home to the *Os Pectoris*, or *Sternym*, tho' the firſt, ſecond, and third of the *Coſta Notha* did. The *Os Pectoris*, or *Sternum*, conſiſted of 7 Bones, according to the Number of the Fore-Ribs that are faſtened to them. At the Beginning of the *Sternum*, there jutted out a ſharp bony *Cartilage*, which, from its Figure I ſhall call *Cartilago Enſiformis*: And here was faſtened one extream of the *Clavicula*. At the End of the *Sternum*, towards the Belly, there was a broad, roundiſh *Cartilage*, which therefore I ſhall call *Cartilago Scutiformis*.

There were 2 *Clavicula* or *Collar-bones*, each an Inch and ½ long, having one Extream faſtened to the firſt *Bone* of the *Sternum*, or the *Cartilago Enſiformis*, and the other End to the *Spine* or *Scapula*, near the Conjunction of it to the *Os Humeri*. By Means of this Bone, it can more advantageouſly bring its Fore-feet to its Mouth, as it uſes to do when it feeds it ſelf, as do the *Monkey-kind*, who have *Clavicula* too as well as Man; tho' many Animals want theſe Bones.

The *Scapula*, or *Shoulder-Blade*, was about 2 Inches long, about an Inch and ½ broad; its *Spine*, tho' thin, yet the nearer it approached the Shoulder, it grew larger and flatter. Fig. 262. Into the *Sinus* of the *Neck* of the *Scapula*, was received the *Head* of the *Shoulder-Bone*, or *Fore-Thigh-Bone*, and to that Protuberance called the *Acromium*, was faſtened the End of the *Clavicula*. This *Thigh-Bone* of the *Fore Legs* was about 2¼ Inches long, 'twas thick and ſtrong, having a large rough Spine jutting forward, and running half the length of it. The lower Extream of this *Thigh bone*, to which was faſtened the *Tibia* and *Fibula*, grew very broad, being almoſt an Inch broad. Above where this Bone began to grow broad, on the outſide was a large Protuberance, and on the inſide there was a great oblong Foramen, or hollow Paſſage, formed by a ſmall Bone ariſing from the inward Fore-part of the Thighbone, where it began to grow larger, and was afterwards united to that part of the Baſis of this Bone, where the *Fibula*, or *Minus focile* is joyned. Juſt in the middle of the Baſis of this Bone, there was a large *Sinus*, which backwards appeared deeper, which did look into another deep *Sinus* of the *Tibia*, by which Means theſe Bones were ſo firmly articulated together, as they were not eaſily, if poſſibly, to be put out of Joint. The *Tibia*, or *Focile majus*, was a ſtrong *Bone*, about 3 Inches long, which was extended upwards above ¾ of an Inch above its *Articulation* with the *Thigh-Bone*, and at the other End was faſtened to the outward *Bone* of the *Tarſus*. The *Fibula*, or *focile minus*, was a ſmaller Bone, placed more inward and forwarder, and not ſo long as the *Tibia*, being *Articulated* above (but not ſo firmly) with the *Thigh-Bone*, and below, with the inward Bone of the *Tarſus*, for there were but 2 Bones of the *Tarſus*, having each a ſmall *Sinus*, for the receiving the Heads of the two *Fociles*. The Bones of the *Metatarſus* were 4, or it may be 5, to which were joined the 5 Fingers or Toes of the Fore-feet. The innermoſt Toe had but two *Articulations*, or *Joynts*, but at the End had a large, hooked, ſtrong Nail; the other 4 Fingers had each 3 *Articuli*, or *Joints*, armed with hooked Nails, as the firſt.

The hinder Legs were faſtened to the Trunk of the Body by the *Os Innominatum*; which in the whole in a ſtreight Line was 3 Inches long. Fig. 263. In the Head of the *Hinder Thigh Bone*, and deeper in, there was a ſpace for the faſtening the Ligament, from which ſpace, there was a *Sinus* which led outward; ſo that the Brims of the *Acetabulum* was not an entire Circle, but broken off here.

Here alſo are the *Oſſa marſupialia*, or *Janitores marſupii*. The hinder *Thigh Bone* was a little above 3 Inches long, 'twas Roundiſh, and a ſtrong Bone: But the *Tibia*, or *majus focile* of the hinder Leg, was ſomewhat longer, a little curv'd. The *Fibula*, or *minus focile*, was about the ſame Length, ſtraighter and ſlenderer. This towards the Foot was articulated to the *Os*

Calcis, as the *Tibia* was to the *Talus* or *Aſtragalus*; and theſe two Bones I make the *Tarſus*; and joyning to them were the Bones of the *Metatarſus*, and to theſe the *Phalanges* of the Fingers or Toes. In the innermoſt, or the *Thumb*, there were only *two Articuli* or Bones, in the other 4 Toes, or *Digiti*, in each there were 3 *Articuli* or *Joints*. The End of the Thumb was more flatted than the Ends of the other *Toes*: For the *Thumb*, as I have obſerved had a flat Nail like a human Thumb: In the others, the Nails were long and curved. I obſerved likewiſe at the Articulation of each Joint of the Toes, on the underſide there were two ſmall Bones, that are called *Oſſa Seſamoidea*, and theſe both in the Fore and Hinder Feet

Explanation of the Figures.

*Fig.*257. Fig. 257. Repreſents the *Poſſum* drawn from the Life.

*Fig.*258. Fig. 258. The *Slit*, or *Aperture* in the Belly, that goes to the *Marſupium*, or *Pouch*

*Fig.*159. Fig. 259. *A.* the *Marſupium* turned the inſide outwards, where may be obſerved the Hair or Fur that covers it, and may help the better to keep the young Ones warm. *BB.* the two hinder Legs cut off. *C.* the Foramen of the *Anus*: which is alſo the common outward Vent, or Exit, to the *Rectum*, the Bladder of *Urine*, and the *Uteri* too. *D.* the Beginning of the *Tail.*

*Fig.*260. Fig. 260. The *Sceleton. A A.* the *Roſtrum* or *Snout. bb.* the *Cranium*, or *Skull*, that did contain the *Brain. ccc.* A bony Ridge, or *Protuberantia Oſſea Longitudinalis*, that did run the length of the *Cranium*, and over a Part of *Roſtrum. d.* the *Lateral Ridge*, which like a Pent-houſe, jutted over the hinder Part of the Cranium, *Protuberantia oſſea Lateralis. e f.* the *Os Zygomaticum*, *e.* its Proceſs from the *Os temporum*, and *f.* that from the *maxilla ſuperior*, or upper Jaw. *g.* A Foramen, or *Hole*, in the inward Canthus of the Orbit of the *Eye*, that leads into the *Noſtrils*, and by a *Duct* conveys the tears, or Moiſture of the *Eyes* into them. *h.* A Foramen, or *Hole* in the upper Jaw, for a Paſſage to the *Veſſels. i.* A Protuberance of the *Os frontis. K.* A *Suture* of the *Os Narium. l l.* the lower Mandible, or *Jaw-bone*, *maxilla inferior. m.* the *ſuperior* Proceſs of the *under Jaw. n.* the *inferior* Proceſs of the *under Jaw. o.* the Clavicula of one Side. *p.* the *Cartilago Enſiformis* of the firſt Bone of the *Sternum. q.* the *Scapula*, or *Shoulder-Blade Bone. r.* the *ſpine* of the *Scapula. S S S S.* the *Thigh-Bones* of all the Feet. *T T T T.* the *Tibia*, or *focile majus* of all the Feet. *u u.* Part of the *Tibia* in the Fore-Legs extended beyond the *Articulation. W W W W.* the *Fibula*, or *Focile minus*, in all the Legs. *x x x x.* the Bones of the *Tarſus*. *y y y y* the Bones of the *metatarſus. z z z z.* the *Toes. a a.* the *Thumbs* in the hinder Feet. 1. the firſt *Vertebra* of the Neck, called the *Atlas*, 2. 3. 4 5. 6. 7. the 2*d.* 3*d.* 4*th.* 5*th.* 6*th.* and 7*th. Vertebra* of the Neck. 8. the firſt *Vertebra* of the *Thorax.* 9. the firſt *Vertebra* of the Loyns. 10. the firſt *Vertebra* of the *Os ſacrum.* 11. the firſt *Vertebra* of the *Os coxygis*, or Tail. 12. 12. 12. 12. the *Spines*, or Hooks, on the inſide of the Tail. 13. 14. the *Os Innominatum* where 13 is the *Os Ilium*, 14 the *Os Iſchii*, or Coxendicis. 15. 15. the *Oſſa marſupialia* ſeu *Janitores marſupii*, ** * *. the Ribs, 13 in all. ☼ the *Cartilago ſcutiformis.*

Fig. 261. The Situation of the *Oſſa Marſupialia*, &c. *aa.* the *Oſſa Pubis.* Fig.261 *b* the *Coalition*, or the joyning of the *Oſſa Pubis cc.* the *Two Oſſe Marſupialia* or *Janitores Marſupii. d e.* the Baſis of the *Oſſa Marſupialia*, where joined to the *Oſſa Pubis. d.* the *Inward Head* of the *Baſis. e.* the *Outward. ff.* the *Acetabulum*, or *Socket*, for receiving the *Head* of the *Thigh Bone. gg,* the *Os Ilium. h h.* the *Vertebra* of the *Os Sacrum. i i.* the *Os Iſchii*, or *Coxendicis.*

Fig 262 The Fore ſide of the *Thigh Bone* of the Fore Leg. *a* the *Head* Fig.26[illegible] of the *Thigh Bone*, where 'tis faſtened to the *Scapula. b.* a large rough *Spine*, which runs above half the length of this *Thigh Bone. c.* a *Protuberance* of this *Bone* on the outſide. *d.* a large *Foramen*, or Hollow Paſſage. *e.* a *Sinus* for Receiving the *Head* of the *Tibia. f g.* the *Baſis*, or lower Extream of the *Thigh Bone.*

Fig. 263. the *Stomach*, and *Guts. A* the *Gula. B B.* the *Stomach c.* A Perforation of the Stomach cauſed by an *Ulcer* there. *dd.* the two Pouchings out of the Stomach at the two Ends. Fig.263 *e.* the *Pylorus. f.* the beginning of the *Duodenum g h i K L M N o p q.* Repreſent the Small Guts, and the *Coyles* and *Convolutions* they do make; ſome of the *Coyles* lie hid, and out of Sight: but the Order how they follow one another, is ſignified by the Order of the Letters of the Alphabet; ſo that *g.* follows *f.* and *g.* is ſucceeded by *i.* and *i.* by *K.* and ſo on to *q.* where the *Ilion* is Diſcharged and Emptied into he *Cæcum*, or if that is full, into the *Colon*, at the firſt Letter *S.R.R.* the *Cæcum. SSS.* the *Colon. T.* the *Rectum. V.* the *firſt Meſenterie*, or *Meſenterium minorum Inteſtinorum. w.* the *ſecond Meſenterie*; or *Meſenterium Majorum Inteſtinorum.*

Fig. 264. The *Urinary*, and *Uterine Parts. AA* the two Kidneys. *bb.* the Fig.264 *Emulgent* Veins. *c c.* the *Emulgent Arteries. d d.* the *Glandulæ Renales. e e* the *two Ureters. f* the Inſertion of the Left *Ureter*, into the *Neck* of the *Bladder. G.* the *Bladder* of *Urine*, turn'd aſide. *h.* the *Urethra. ii.* the *two Vaginæ Uteri. K.* the *common Paſſage* from the *Urethra*, and the *two Vaginæ. l.* the *Arteria Aorta*, or *Great Arterie. m.* the *Vena Cava. n n n.* the *Spermatick Arteries. o o o o.* the *Spermatick Veins. p p p.* the *Hypogaſtrick Arteries* and *Veins. r r r.* the *Alæ Uteri, ſeu potius Cornuum. S S* the *Ovaria. t t.* the *Tubæ Fallopianæ. u u.* the *Cornu Uteri* of the *Left ſide opened. w.* the *Cornu Uteri* of the *Right ſide* not opened. *x x.* the *two Uteri* opened. *y.* the *Diaphragm* that divides the *two Uteri. z z.* the *Imperfect Diaphragma* which partly divides each *Uterus*, and lies over the Paſſage of that part of the *Uterus*, which is doubled and tends to the *Vagina*

Fig. 265. The *Uterine Pars* more particularly. *AA* the *two Ovaria. b b.* Fig 265 the *Fimbria Foliacea. cc.* the *Tubæ Fallopianæ. d d.* the *two Cornua Uteri. EE* the *two Uteri* Reduplicated. *f.* a *Slit* in the *Neck* of the *Left Uterus* to ſhew its Paſſage into the *Vagina* on that ſide. *g.* the *Left Vagina* opened. *h.* the *Oſtium*, or *Mouth*, of the *Right Vagina. i.* the *common Paſſage* from the *Urethra* and *Vagina. K.* the *Urethra. l l.* the *Bladder* of *Urine* cut off. Fig.266

Fig. 256. the *Hairy Tophus.*

Fig 267 Fig. 267. The *Liver*. *A*. the *Vena Cava* *BBB*. the 3 *Lobes* of the *Liver*. *C*. the *Bladder* of *Gall*. *d d d*. the *Fiſſures* in the Body of the *Liver*. *e e e*. the *Inciſures* at the Edges of the *Liver*.

Fig. 268 Fig. 268. *A*. the *Spine* of the 2*d*. *Vertebra* of the *Neck*. *b* Repreſents its Thickneſs. *c*. a large *Sinus* for the receiving the *firſt Vertebra*. *d*. the *Dens*, or *Tooth* of this *Vertebra*. *e*. the *Proceſſus Obliquus Superior* of one ſide. *f*. the *Proceſſus Obliquus Inferior* of the ſame ſide.

Fig. 269 Fig. 269 *A*. the *Spine* of the 3*d Vertebra* of the *Neck*, where is ſhewn its Natural Thickneſs. *b*. the *Hole* through which the *Medulla Spinalis* Paſſes. *cc*. two ſmall *Foramina* for the Paſſage of the *Veſſels*. *d*. Repreſents the *Cleft* at the Top of the *Spine*. *e e*. the *two Proceſſus Obliqui Superiores* before. *f f*. the *two Proceſſus Oblique Inferiores* before.

Fig. 270 Fig 270. The *firſt Vertebra* of the *Thorax*. *A*. the *Spine*, which is long and Acute. *bb*. the *Oblique Proceſſes* before. *cc*. the *Oblique Proceſſes* behind. *dd*. the *Tranſverſe Proceſſes*. *e e*. where the *Ribs* are faſtened. *f*. the *Hollow* where the *Medulla Spinalis* paſſes.

Fig. 271 Fig. 271. The 4*th Vertebra* of the *Loins*. *a a*. the *two upper Oblique Proceſſes* behind. *b*. the *Spine*. *cc*. the *two under Oblique Proceſſes* behind.

Fig. 272 Fig. 272. The 2*d*. and 3*d*. *Vertebræ* of the *Tail*. *aa*. *two Vertebræ* of the *Tail*. *b b b*. the *Spines*, or *Hooks* on the inſide, by means of which it can better *hang* by its *Tail*. *c c*. A *Hollow*, or *Foramen*, in the middle of theſe *Spines*, through which *Blood Veſſels* Paſs.

A Monſtrous double Turkey; *by Sir* J. Floyer. n. 257. p. 434. CX. At *Thorpe* in *Staffordſhire*, *two Young Turkeys*, were taken out of an *Egg*. (of the Ordinary Size) when the reſt of the Eggs were well hatched, which *Grew together* by the Fleſh of the Breaſt Bone, but were in all other Parts Diſtinct. They ſeemed leſs than the ordinary thickneſs of *Turkeys*: for there wanted both *Nutriment* and *Room* for their Growth; which was the occaſion of their *Coheſion* and *Smallneſs*. They had *Diſtinct Cavities* in their *Bodies*, and *two Hearts*: ſo that they had *two Diſtinct Cicatricula's* and Conſequently the Egg had *two Yolks* in it, from whence they were produced; which Accident is very Common. But I have a dryed *Monſtrous Chicken* which had but *one Head*, 4 *Wings*, 4 *Legs*, and *one Cavity* in the *Body*, and conſequently had but *one Heart*: in this Caſe this *Monſtrous Chicken* was produced from one *Cicatricula*. So *Paræus* mentions a *Double Infant* with *one Heart*. In theſe Caſes the *Original* of the *Infant* was one, and the *Veſſels Regular*; but in the Extremity, the *Arteries* and *Nerves* were divided into more Branches than Ordinary, and produced *Double Parts*. And this is like the double Flowers of Plants, which are produced ſo, by the Richneſs of the Soil. And, thus it is in the Eggs of *Quadrupeds*; they are Joyned in the *Ovarium*, and as they Grow their Bodies do externally *Cohere*. So that I may Obſerve, that there are theſe two Reaſons of the Multitude of the Parts in an *Embryo*; the Joyning of two Perfect *Animals*, or elſe the Extraordinary Diviſion of the *Original Veſſels*, the *Arteries* and *Nerves*.

A Monſtrous Colt; *By* Mr. R. Boyle. n. 5. p. 85.

Fig. 273.

CXI. The Body of this *Colt* appeared to the Eye Compleatly Formed, without any *Monſtroſity* to be taken Notice of in it: But the *Head* being opened, and examin'd, it was found, that it had no Sign of any Noſe in the uſual place. The two Eyes were united into one Double Eye, which was placed juſt in the middle of the *Brow*, the Noſe being wanting which ſhould have ſeparated them: Whereby the two Eye Holes in the Skull were united into one very large round Hole, into the midſt of which, from the *Brain*, entered one pretty large *Optick Nerve*, at the End of which grew a great *Double Eye*; that is, that *Membrane*, called *Sclerotis*, which contained both, was one and the ſame, but ſeem'd to have a Seam, by which they were joyned, to go quite round it, and the *Fore* or *Pellucid Part* was diſtinctly ſeparated into two *Cornea*'s, by a *White Seam* that divided them. Each *Cornea* ſeem'd to have it's *Iris* (or *Rainbow-like Circle*) and *Apertures*, or *Pupills*, *Diſtinct*, and upon opening the *Cornea*, there was found within it two *Balls*, or *Chryſtalline Humours* very well ſhaped. The *Eye Lids* were alſo a little divided in the middle. Juſt above the Eyes, as it were in the midſt of the *Forehead*, was a very deep Depreſſion and out of the midſt of that, grew a kind of *Double Purſe* or *Bag*, containing little or nothing in it: but to ſome it ſeemed to be a Production of the matter Deſigned for the Noſe, but diverted by this *Monſtrous Conception*; perhaps the *Proceſſus Mammillares*, Joyned into one, and were covered with a thin Hairy Skin.

A Monſtrous Calf; *By* Mr. Dav. Thomas. n. 1. p. 10 n. 2 p. 20.

CXII. A *Butcher* (at *Limmington* in *Hampſhire*) having killed a fatted *Cow*, and opening the *Womb*, found in it a *Monſtrous Calf*, which begun to have Hair. The Feet of this *Calf* were ſo parted as to be like the *Claws* of a *Dog*; the *Legs* had no Joynts; and the *Tongue* was, *Cerberus-like*, *Tripple*, to each ſide of his Mouth one, and one in the midſt. Between the fore Legs and the hinder Legs was a great Stone, on which the *Calf* rid. The Skin of the Breaſt, and between the Legs, and of the Neck (which Parts lay on the ſmaller End of the Stone) was much thicker, than on any other Part. The Stone (which was bigger at one End than the other) Weighed. $20\frac{1}{2}$ Pounds, the outſide was of a Greeniſh Colour; and not Plain, but full of little Cavities; when broke, it appeared full of ſmall Pebble Stones, of an *Oval Figure*; its Colour Gray like Freeſtone, but intermixt with Veins of Yellow and Black.

A Monſtrous Calf *with* 2 Heads; *By* *Sir* Rob. Southwel. n. n 238. p. 79.

CXIII. *Jan.* 11. $167\frac{7}{8}$. A *Cow* of Mr. *Will. Dabs*'s, at *Milnecoat* in *Warwickſhire*, brought forth a *Monſtrous Calf*; having one perfect large *Head*, and on the right Side of that, grew another, almoſt as large, and of true Shape, having both *Tongue* and *Teeth*; and from the *Roof* of the *Mouth* of the *Monſtrous Head*, hung down a piece of Fleſh, with the ſhape of a *Tongue* upon it, and a row of *Teeth*, as on an under Jaw: which occaſioned the Man who ſhewed it, to ſay that it had 3 Mouths. It had to each Head 2 Eyes, only thoſe of the Monſtrous were very ſmall, and I believe had no Sight. It had only 2 Ears to both Heads, one of which was placed on the Far-ſide of the Monſtrous Head, the other as uſual in other Calfs. It *Breathed* equally at both Mouths, and had Communication with the ſame Throat, but took its Nouriſhment only at the Perfect Mouth, the under Jaw of the order being ſo Weak, that the Mouth always ſtood open and drivell'd. It appeared on the Left ſide to be a Perfect *Calf*, and look'd very lively, and was at 3 Days Old, as large and ſtrong as other *Calfs* uſually are at 10 Days, or a Fortnight.

Two Monſtrous Lambs, by Mr. Colepreſs. n. 26. p. 480.

CXV. *Feb.* 24. 1664. *Rob. Cloak*, of *Beer Ferris* in *Devonſhire*, had a *Black Ram-Lamb* fallen with one Head, but two Diſtinct *Bodies*, with 8 Legs, which *Bodies* were Joined in the Neck. It had 2 Eyes and as many Ears, in the uſual Places; and one Extraordinary Eye in the *Niddock*, with one ſingle Ear, about an Inch diſtant from the Eye backwards. Its Dam uſually brought forth two Lambs every Year, as ſhe did this Year alſo; which with the *Ewe* remains Alive; but this Monſter was found Dead by the Hedge.

About the ſame time, *John Cauce*, of the ſame Pariſh, had a *White Lamb* fallen, with 2 Diſtinct Heads and Necks, joined at the Shoulders, but one only *Body*; and that well formed, yet having Double Entrails in all Reſpects. The *Ewe* remains Well, but the Monſter Dy'd.

A Monſtrous Pig. By . . . n. 147 p. 188

CXV. In *December* 1682. Among many *Pigs* of a *Sow*, there was one which had no Paſſage for the *Faces*, either Solid or Liquid, although the *Anus* was not outwardly cloſed up; and being diſſected, we found the *Guts* very much Diſtended and Tranſparent, and thro' them appeared the *Feces* very Liquid, accompanied with no ſmall quantity of Wind. The End of the *Rectum* was entirely cloſed like a *Bladder*, and *Sealed* as it were, *Hermetically*, *Pendulous* in the *Cavity*, and not in the leaſt continued to a *Sphincter*, of which there was no Sign: There was no *Bladder* to be found, nor *Uterus*, nor any Mark of what Sex it was deſigned for: But both the *Ureters* were Inſerted into the *Rectum*, within an Inch, or thereabouts, of the End. The Stomach was full, even to Diſtenſion, of an Hard Subſtance, which appeared exactly the ſame with hard preſs'd Curds. The *Chyle* came freely enough out of the *Ductus Peequelitanus*, where it was inſerted into the *Jugular*, upon the ſmalleſt preſſure of the *Inteſtines*: But I could not Urge the *Liquid* or *Flatulent Contents* of the *Guts* upwards, within two Inches of the *Pylorus*, tho' I preſſed them till they Brake.

Two Monſtrous Pigs; by Sir J. Floyer. n. 255. p. 431

CXVI. In *May* 1699. There was ſhewed to me a *Pig* at *Weeford* in *Staffordſhire*, with a Face ſomething Repreſenting that of a Man's, and the Chin was very like that of an *Humane Fœtus*. But when I had well conſidered the Head, I obſerved there was a Depreſſion of the Bones of the Noſe, in that Place which was betwixt the Eyes, in which the *Pig*'s Face ſeemed to me to be Broken, and the Noſe drawn up to appear like an *Humane*. The under *Jaw* was Inverted, to grow up to meet the upper; the Tongue and Mouth were made more like an *Humane* being altered by ſome External Preſſure upon the Mouth of the *Pig*, which broke the Bones of the Noſe, and cauſed their Depreſſion towards the *Palate*, and the *Inverſion* of the *under Jaw*. This *Preſſure* on the Mouth forced the *Bones* upward, ſo much as to cover the *Eye-Holes*, and the Pig appears Blind. *A.* is the Place of the *Bone Depreſſed*; *B.* is the Depth of it. It cloſed it ſelf with a Spring, when we opened it by Force; ſo that it had Grown cloſed up, ever ſince it was *Cartilaginous*. By this Breach, or Depreſſion of the Pig's Face, I was firſt Convinced, that this Monſter was not produced by the *Copulation* of two *Species*, as was uſually apprehended, but only occaſioned by the Perverſion of the Compreſſion of the *Womb*, or *Placenta*, or other Pigs in the ſame Part of the *Womb*. And that the Pig's Head was ſtreightned in its Growth, appeared by the Flatneſs of the Ears, and that this Depreſſure happen'd whilſt [illegible] were *Cartilaginous*, appears by the Bones depreſſed, which remain a *Ca[illegible]ginous*, and at the ſame time the under *Jaw* was Inverted, and the Head made more Round. I farther obſerved, that all the Head was covered with Hair, as the other Pigs were; that the *Teeth* in the Mouth were Pig's *Teeth*; the Hair of the Pig's Head was Yellow, as that of the Sow's was; the Monſtrous Pig was as big, and as well Grown as the reſt of the Pigs, and therefore begot by the *Boar* at the ſame Time; the Noſe was a Perfect Pig's Snout, and there was no upper Lip, as in the Human Kind. In all the other Parts, it appeared to be a Perfect Pig; no Parts were wanting, but thoſe of the Face, diſtorted by ſome External Accident. At the beginning of the 17*th* Week, from that Time when the *Sow* took the *Boar*. which is the uſual Time the *Sow* Pigg'd 8 Pigs, the firſt 5 were Perfect Pigs, the Sixth was the Monſter, and after that two more Perfect Pigs. This Monſter was Pigg'd Alive, but dyed becauſe it could not Suck, the Noſe being Stopped The Cry of the Pig was not like the other Pigs, becauſe of the Stoppage of its Noſe, and the Alteration of the Figure of its Mouth.

This Kind of Monſtrous Pigs, produced by the Unnatural Situarion of Parts, by ſome External Compreſſion, I believe is very frequent; becauſe I had another of the ſame kind, ſent me out of *Darbyſhire*, which had a Reſemblance of a Man's Face, and all the other Parts of a Pig, and this had the ſame Chin, and Depreſſion betwixt the Eyes, the Roundneſs of the Head, and Flatneſs of the Ears, I have above deſcribed. But this *Derbyſhire* Monſter wanted Hair, as Pigs which come too ſoon do; and no *Sex* could be diſtinguiſhed in it: But the former deſcribed was a *Boar Pig*.

The Anatomy of a Monſtrous Double Cat, By Dr. Mullen. n. 174. p. 1135.

CXVII. This Monſtrous Catling was Dead when I met with it, and I am perſwaded that it was ſo brought forth, the Lungs being Compact and free from Air, which they could not be, if it had ever Inſpired. It was Double from the *Navel* downwards, having 4 *Hind feet*, 2 *Tails*, 2 *Anus*'s, and 2 *Pudenda*; for they were *Females*. They were Jointed into one *Trunk* at the *Navel*, and were continued ſo upwards: but yet this Monſter had 2 Pair of *Fore-feet*, one of them on the Back, and the other on the Breaſt. The Head, though ſingle, had two Pair of *Ears*, one naturally Seated, and another at the hinder part of the Head, between the *Proceſſus Mammillares*, to which the *Vertebra* of both the Necks were Joined. Fig. 275.

There was only one Stomach under the Liver in the Right ſide, reaching under another Liver in the left. The Guts were ſingle till within 6 or 7 Inches of the *Anus*, and there was a Diviſion into two Branches, one going to each *Fundament*, below the Diviſion there were plainly to be ſeen two *Cæcums*, within about 3 Inches of the *Anus* each. There were two Livers, one much ſmaller than the other, that which was in the Right ſide was the leaſt, the other lay lower down in the left ſide, they were both entire without any Diviſion or *Lobes*. There was a *Vena Umbilicalis* inſerted into each of them. There were *two Arteries* inſerted into the Liver in the left ſide, both coming from the *Aorta*, and theſe I ſhall call the *Cæliaca*; but there was only one inſerted into the *Liver* placed in the right ſide. There was no *Vena Cava* below the Livers, for [illegible] Veins coming from the lower parts entered the Livers as the *Vena Porta* does naturally There was a Branch of a Vein on each ſide proceeding from the Loins inſerted into the Back parts of the Liver: and beſides theſe, there was not a Branch to be ſeen, but what was inſerted into the middle of the Livers. There were *two* Kidneys on each ſide furniſhed with *Ureters*. There was neither *Spleen* nor *Pancreas* in either ſide.

There was a *Double Diaphragm* meeting in the middle between the *two* Back Bones, and making a *Membrane*, which to me ſeemed to be a *Mediaſtinum*, for it reached up to the *Thymus*. There were 2 Hearts in it, one placed above the other, and a little to the Right ſide, it was much higher than ordinary, and it had a Vein coming to it from the little Liver in the Right ſide, which (together with 3 other ſmall Veins, one from each of the *Fore Feet*, and one from the Head) furniſhed this Heart with what Blood was to be Circulated by it. It had only one *Auricle*, and one *Ventricle*: ſo that it ſeemed to be but half a Heart There was a pretty large Paſſage into the *Arteria Aorta*, the Contrivance of which was very ſingular; for above this Heart it was made like an Arch of a Circle, into which there was a direct Paſſage from the Heart for the Blood. When I further Examined this *Artery*, I found that it went down on each ſide on the *Vertebra* of the Backs between the Kidneys, and Divided it ſelf on each ſide after the uſual manner, after it had lent each Kidney a Branch, the Liver in the Right ſide one, and the Liver in the Left ſide two. Below the former, a little towards the Left ſide of it, there was another half Heart, having only one *Auricle* and one *Ventricle* like the former. This received a little Blood but what was tranſmitted from the large Liver in the Left ſide, by that that is call'd the *Truncus Aſcendens* of the *Vena Cava*. The *Artery* carrying the Blood from this Heart, was inſerted into the *Artery* lately deſcrib'd, as well as that of the other Heart. So that if the Blood Circulated through either of them the whole Animal muſt neceſſarily be ſupplied with Blood, a Contrivance not unlike that of the *Arteries* under the Brain, where the *Arteriæ Carotides* and *Vertebrales* do Empty themſelves into one Common Channel, from which all parts of the Brain may eaſily be ſupplied with Blood.

The Head was Joyned to two Necks about the *Proceſſus Mammillares.* Fig.278.

There were 4 Orders of *Ribs*, though the Body was but one above the *Navel.* Fig.279.

Explication of the Figures.

Fig 275. Expreſſes to the Life the outward Shape, when placed on its Back. Fig.275.

Fig. 276. The *Cat Opened.* 1. the *Stomach*, pull'd from behind both the *Livers*, ſo as to be plainly ſeen. 2. the beginning of the *Guts* below the *Pylorus.* 3. the Diviſion of the Gut into two Branches, whereof one went to each *Anus.* 4. 4. the *Two Cæcums.* 5. 5. 5. 5. the *Two Pair* of *Kidneys*, furniſhed with *Emulgent Arteries* and *Veins.* 6. A large *Liver* in the Left ſide, much lower ſituated than the *Liver* in the Right ſide. 7. the *Liver* in the Right ſide, with a *Vein*, 8 coming from the *Kidneys* of the ſame ſide, after it had United above the *Emulgents*; this ſupplies the Office of the *Vena Cava* and *Vena Porta.* 9. 9. two large Branches of the big *Artery* going into the Body of the big *Liver.* 10 10. 10. 10. the Great *Artery*, ſupplying both ſides with Blood, and Receiving of it from the two *Hearts.* 11. the Vein, bringing the Blood from the lower Parts of the Left ſide into the *Liver*, 6 of the ſame ſide. 12. 12. the big *Artery*, ſending Branches to each of the *Kidneys.* 13. the upper *Heart.* 14. the *Artery* that ſupplied the Head with Blood. 15. 15. the *Axillary Arteries.* 16. the *Vena Cava* coming from the *Liver* in the Right ſide to the Heart. 13. 17. the Paſſage from the ſaid Heart to the *Aorta.* Fig 276.

Fig. 277. 1. The *Liver* in the Left ſide, freed from all things that kept it any way out of Sight. 2. the *Vena Cava* paſſing from it to the lower *Heart*, 6. 3 A Skirt of the *Diaphragm* turned to the Left ſide, that the former Vein ſhould better appear. 4. the *Stomach*, diſplaced for the former Reaſon. 5. 5. 5. 5. the *Kidneys.* 6. the lower *Heart*, in its due Situation. 7. the upper *Heart*, drawn out of its place upwards that the other, 6. with the Paſſage 11. from it to the *Aorta*, 9. 9. might be well Repreſented. 8. 8. the *Liver* in the Right ſide, doubled and turn'd over the *Heart*, 6. that it might be the better ſet forth. 9. 9. 9. the *Aorta*, where it is not hid by the Parts diſplay'd for the former Reaſon. 10. the *Lungs* not well Repreſented. 11. the Paſſage from the lower *Heart* into the *Aorta.* Fig.277

Fig. 278. The Skull opened, and freed from the Brain. 1. 1. the Hollows, through which the *Medulla Oblongata* was continued to the *Medulla Spinalis.* 2. 2. the two Necks. Fig.278.

Fig. 279. 1. 1. The *Two Diaphragms* ſeparated from the *Cartilages* of the Ribs, that their *Junctures* may be ſeen. 2. 2. 2. 2. The *Vertebra* of both the Backs. 3. 3. 3. 3. 3. 3. the *Juncture* of the two Setts of Ribbs that were at the Back. 4. 4. 4. 4. the two Setts of Ribs that were joyned to the Breaſt. 5. the Tips of the *Diaphragms*, pull'd downwards to ſhew the *Ribs* plainly. 6. 6. the *Vertebra* of the two Necks. Fig.279.

An Animal *reſembling a* Whelp *void-ed* per Anum *by a* Male Greyhound; *By Mr.* Edm. Halley. n. 222 p. 316.

A Bitch *with* Puppy, *the ſhe had loſt the* Spleen; *By* —— n 105.p.117

A Cow *with* Four Calves; *By Sir* J. Floyer. n. 259 p. 435

A Hen *with a* perfect Chick *in the* Ovarium; *By*. . . . n. 50 p 1019.

An Egg *found within another* Egg; *By*. . . . n. 230. p. 532

Ova *found in a* Cow; *By*... n.74.p.2218

The Ova, *after a 2d* Conception, *aſperſed in the* Abdomen *of a* Bitch, *tho the* Cornua Uteri *were filled with the* Bones *and* Fleſh *of a* Former Conception; *By*... n.147.p.183

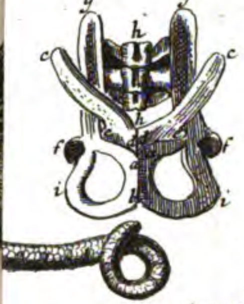


Fig. 261.

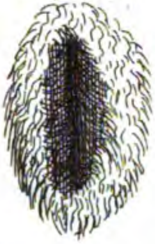
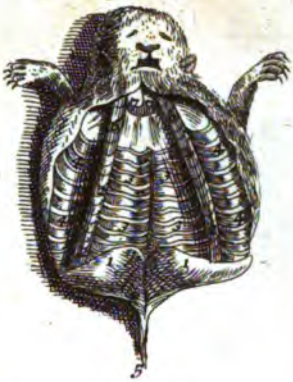


Fig. 258.



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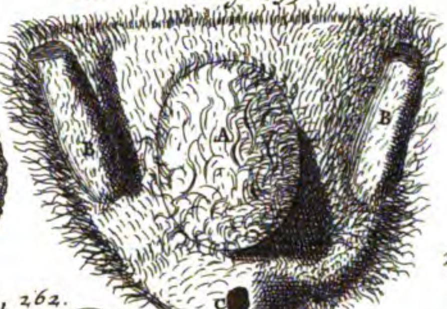

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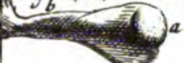

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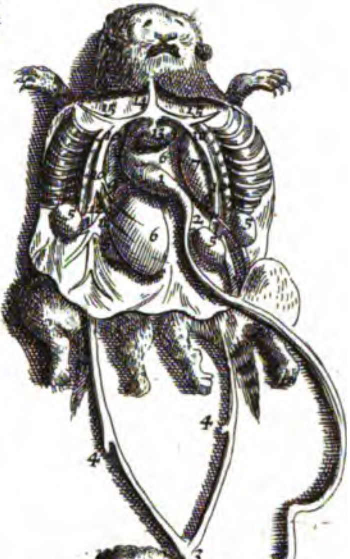

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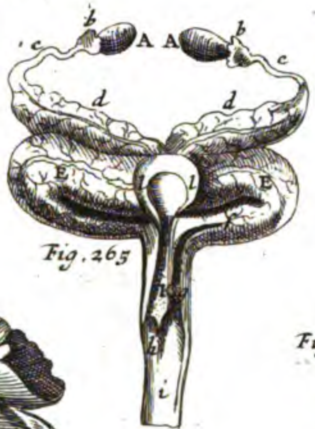

Fig. 263

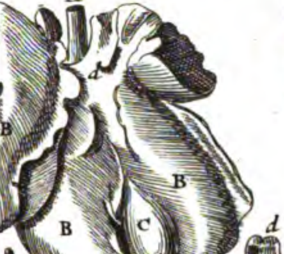

Fig. 267.

. 270.

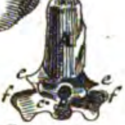

Fig. 269.

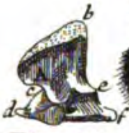

Fig. 268

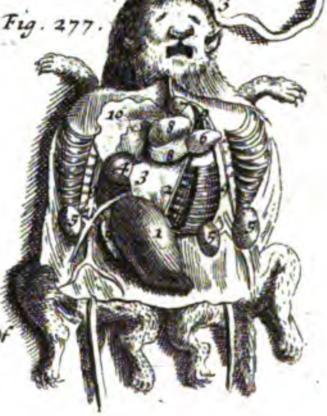

Fig. 277.

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nion of the *Production of Animals* from the *Mixture* of the ſeminal Matter of both Sexes, 'twas not ſo difficult to diſcover whence the Egg came, which he ſaw about 7 Weeks after *Impregnation*. The *fallopian Tubes*, which joyn to the Horns, and terminate very near the *Ovaria*, (as the *Teſtes muliebres*, are generally now call'd) directed the ingenious and induſtrious *de Graff*, to make more accurate Diſſections of them: And he has ſo very nicely obſerv'd the Progreſs of the Eggs in *Conies*, the very time of their paſſing into the Tubes, and appearing in the Horns of the Womb, (which comes very near that Proportion of time Dr. *Harvey* obſerved the Eggs in his Deer) that the Opinion of the Production of all Animals from Eggs, is now almoſt univerſally received.

Some time ſince indeed the learned *Diemerbroeck*, and very lately Mr. *Verney*, have endeavoured to confute this Opinion, and expoſe it. The moſt conſiderable Argument they uſe is taken from the Narrowneſs of the *Fallopian Tubes*, where they open into the Womb, and at their Extremities. But Dr. *de Graff* prevented this Objection, by alledging, that the *Hole* by which it has its Exit out of the *Ovarium* is as narrow; that no Force is uſed to open it, but it expands it ſelf as the *Os Uteri* before the Birth: As Nuts and Peach-ſtones, *&c.* give Way to the *Germinating Plant*, which is leſs able to make its Way than the Egg. But beſides, which theſe Authors urge, tho' the Extremity of the Tube be membranous in moſt Quadrupeds, in which its poſſible a Seminal Liquor might be tranſmitted into the Womb, in *Women* it's divided, like a Knot of *Ribbon*, and is no more adapted to receive any thing but an Egg, than the Fingers expanded to receive and contain a Fluid. The Egg has not been able ſometimes to get into the Womb; *Riolanus* ſpeaks of a humane Fœtus ſeen in one of the Tubes, and Dr. *Harvey* aſſures you he has ſeen it himſelf.

Vid. inf. Vol. III. Cap. 4. §. CVIII. *&c.*

In the Diſſection of a *Bitch* at *Oxford*, it was obſerv'd, that the *Embrio's* either could not get into the *Womb*, the membranous Expanſion being hindred from aſcending to and clipping the *Ovaria*, by the fullneſs of the *Womb*, or from the ſame Cauſe were forc'd back again. She had been with Whelp; by a Blow ſhe received the Fœtus died within her. She diſcharged by the *Pudendum* a great Quantity of putrid Fleſh and Matter. She was afterward able to run in the *Pack*. After the 2d. *Impregnation*, ſhe was obſerved to have a very ill ſhap'd Belly. When dead, the Owner, a Perſon of Quality, ſent her to *Oxford*. The Horns of the *Womb* were ſo ſtuft up with the Bones and firmer Muſcles, and thicker Skin of the Fœtus's, (ſome of them lay in the uſual Poſture, the Skeletons of which were entire, the Interſtices of the Bones only fill'd up with Skin and Fleſh) that no ſeminal Matter, or *Aura ſeminalis* could poſſibly find a Paſſage to the *Ovarium*. The Eggs affected in the 2d. *Impregnation*, finding no Room in the *Horns*, were forc'd back into the *Abdomen*. Where they were found affixt to the *Meſentery*, *Kidney*, *&c.* Only two of the Bags had a Communication with the Womb by a ſlender *Duct*. Theſe I ſuppoſe fell into the Horns firſt, and began to faſten to them, but growing larger were forc'd to retire. The other three had no Reception there at all. The Membranes which contained the Embrio's, were all of them very thin, and the Animalcules in them had wanted a due Supply of Nutritious Matter. This ſeems to give as clear a Proof of the Truth of the modern Opinion, as can be expected or deſired.

But if *Anatomy* had not diſcovered Eggs, and demonſtrated their Uſe and Progreſs to the Womb, it would be very difficult to conceive how an *Animal* could be produced from the Mixture of the *ſeminal Liquors* of both Sexes Every *Animal* (tho' upon other Accounts eſteem'd the moſt deſpicable,) is made up of ſo many different Parts, and thoſe of ſo excellent a Contrivance, and ſo wonderful a reſpect to one another, that 'tis not to be imagined, that the ſeminal Fluids lying looſe, and at large in the Capacity of the *Womb*, and expoſed to ſo many Accidents, could give a Production ſo admirable. Every Jog of it from the frequent Motions of the Female, would diſturb and diſtract the preſent Deſigns of the *plaiſtick Power* they ſpeak of. The Humours and Vapours which have a Paſſage to, and humect all the Parts of the Body, would in the *Womb* break in on the ſoft ſeminal Maſs, and break off the tender Filaments when firſt a forming. In Quadrupeds the *periſtaltick Motion* of the Horns would perpetually ſeparate the Parts of the ſeminal Collection and ſcatter thoſe Pieces, which Nature is putting carefully together into the Fabrick of an *Animal*. From this Way of Conception, Monſters would be very frequently brought forth, and would be much leſs wondred at, than a perfect Production is now. We ſee how very induſtrious Nature is in preſerving the Species of Vegetables. When the tender Seed is firſt formed, it's ſecured from external Injuries by various ſorts of Caſes. The *Embrio* of the Plant contained in the Seed hath 3 or 4 Coats to encloſe it: the outermoſt is deſigned of ſufficient Strength to preſerve it. None of the *Juices* of the Earth are permitted to enter in, but ſuch as are fit to put into Motion, or ſupply the Liquor contained in the inner Membrane, from whence it has its firſt Increaſe. And as the Eggs of Animals are deſigned for the ſame Purpoſe the Seeds of Vegetables are, ſo there is very great Agreeableneſs between them. The Shell and Membranes of Eggs (except thoſe which are brought to Perfection in the Female Sex) are very like thoſe of Seeds; both have a *Colliquamentum* or more fine and ſpirituous Liquor, which is firſt to be ſpent before thoſe which are groſſer can be receiv'd in the extremely fine and ſmall Pores of the Fœtus, when only juſt begun to be formed; and in both, the Parts of the *Embrio* are deſigned and drawn out, before the Egg has been at all affected by the *Maſculine Seed*, or the *Vegetable Seed* put into the Womb of the *Earth*. The Figure of the Plant may be ſeen in the larger Seeds, and Miniature of a *Chick* in the ſpot of the *Yolk*.

But if ſo great and ſo various an Artifice is neceſſary to raiſe a Plant, ſhall *Nature* be thought leſs careful and induſtrious in the *Propagation* of Animals, whoſe Parts are more numerous, and of a much finer Texture? And ſince thoſe Animals and Vegetables are by ſome allowed to take their Original from Eggs and Seeds, whoſe Largeneſs will permit them to obſerve them, it ſeems an Opinion with too much Precipitancy taken up, that ſuppoſes ſome of the greater *Animals*, and the leaſt of theſe, and Plants, are ſupplied from Equivocal Generation; that corrupted Matter from the Warmth of the Air, or the Motions of its own Principles, can form the Parts of the one or the other. For the Heat of the Air endeavours to diſſipate and remove the thinner Parts from the more groſs: ſince no Membrane is ſuppoſed to confine them: And the more active Principles are from their own Nature always ſtrugling to be quit of them. And this Way, the Parts of an *Animal* would be ſooner broken into pieces, than a new one generated.

But they believe it may be allowed, that the leaſt and moſt inconſiderable Animals and Plants, are this Way formed. But their Minuteneſs makes the Difficulty greater: A Membrane to include the *Conception* with its firſt Nouriſhment ſeems more neceſſary here, where the Parts are more delicately put together, and from their exceeding Fineneſs might more eaſily miſcarry. But if after this Method ſome Animals and Plants can be produc'd, why is the ſame Species and theſe very Individuals they ſuppoſe ſo made, furniſh'd with Organs for Univocal Generation? If *Slime* and *Mud* can afford *Frogs* and *Eels*, why does the firſt Spawn ſo many Eggs, and are the other Viviparous? Why does not ſo great a Diverſity of putrid Parts in the Earth, differently affected by unaccountable Accidents, often preſent us with new Living-Creatures, and Vegetables of peculiar Species? But no ſuch new Plants are taken Notice of, and the Mites are of the ſame ſort from Cheeſe and from Meal. The Objection which is offered againſt *Epicurus*, will be made with the ſame Force againſt this Opinion: If the Earth at firſt equivocally produc'd Men, Quadrupeds, Birds, and Fiſh, why has it not done it very frequently or at leaſt ſome times ſince? We begin to ſuſpect the Cheat, when the Artiſt is not able to perform the ſame again.

The modern Theory of Generation, by Dr. G o. Garden n 192. p. 474.

CXXVI. 1. Upon comparing the Obſervations and Diſcoveries of Dr. *Harvey*, S. *Malpighi*, Dr. *de Graaf*, and M. *Leewenhoeck*, with one another, theſe three things ſeem to me very probable. 1. That Animals are *ex Animalculo*. 2. That the *Animalcules* are originally *in Semine Marium & non in Fœminis*. 3. That they can never come forward, nor be formed into *Animals* of the reſpective Kind, without the *Ova* in *Fœminis*.

The firſt of theſe ſeems probable from theſe 3 Obſervations; 1. That ſome ſuch thing has been ſo often obſerved by *Malpighius* in the *Cicatricula* of an *Egg* before *Incubation*, as the Rudiments of an Animal in the Shape of a *Tadpole*, as may be ſeen in his firſt, and in his repeated Obſervations, *de Formatione Pulli in Ovo*. 2. The ſudden Appearance and Diſplaying of all the Parts, after Incubation, makes it probable, that they are not then actually formed out of a Fluid, but that the *Stamina* of them have been formerly there Exiſtent, and are now expanded. The firſt Part of the *Chick* which is diſcovered with the naked Eye, is, you know, the *Punctum Saliens*, and that not till three Days and Nights of *Incubation* be paſt; and then on the fifth Day the Rudiments of the Head and Body do appear. This made Dr. *Harvey* conclude, that the Blood had a Being before any other Part of the Body, and that from it all the Organs of the *Fœtus* were both formed and nouriſhed; but by *Malpighius*'s Obſervations, we find, that the Parts are then only ſofar extended as to be made viſible to the naked Eye, and that they were actually exiſtent before, and diſcernable by Glaſſes. After an *Incubation* of 30 Hours, are to be ſeen the Head, the Eyes, and the *Carina*, with the *Vertebræ*, diſtinct, and the Heart. After 40 Hours its Pulſe is viſible, and all the other Parts more diſtinct, which cannot be diſcerned by the naked Eye before the beginning of the fifth Day; from whence it ſeems very probable, that even the ſo early diſcovery of thoſe Parts of the *Fœtus* by the *Microſcope*, is not the Diſcerning of Parts newly formed, but only more Dilated and Extended by receiving of Nutriment from the *Colliquamentum*; ſo that they ſeem all to have been actually Exiſtent before the Incubation of the Hen. And what *Swammerdam* has diſcovered in the Tranſmutation of Inſects, gives no ſmall Light to this, whilſt he makes appear in the Explanation of the 13*th Table* of the *General Hiſtory of Inſects*, that in thoſe large *Eruca*'s which feed upon Cabbage, if they be taken about the time they retire to be transformed into *Aurelias*, and Plunged often in warm Water to make a Rupture of the outer Skin, you will diſcern through the Tranſparency of their ſecond Membrane, All the Parts of the *Butter-fly*, the *Trunk*, *Wings*, *Feelers*, &c. folded up: But, that after the *Eruca* is changed into an *Aurelia*, none of theſe Parts can be Diſcerned, they are ſo drencht with Moiſture, though they be there actually formed.

Another Conſideration is from the *Analogy*, which we may ſuppoſe, between *Plants* and *Animals*. All Vegetables we ſee, do proceed *ex Plantulis*, the Seeds of Vegetables being nothing elſe but little Plants of the ſame kind folded up in Coats and Membranes; and from hence we may probably Conjecture, that ſo curiouſly an Organized Creature as an Animal, is not the ſudden Product of a Fluid, or *Colliquamentum*, but does much rather proceed from an Animalcule of the ſame Kind, and has all its little Members folded up according to their ſeveral *Joynts* and *Plicatures*, which are afterwards enlarged and diſtended, as we ſee in Plants. Now though this Conſideration alone may ſeem not to bear much Weight, yet being joined to the two former, they do mutually ſtrengthen each other. And indeed all the Laws of Motion which are as yet diſcovered, can give but a very lame Account of the forming of a Plant or Animal. We ſee how wretchedly *du Cartes* came off when he began to apply them to this Subject. They are formed by Laws yet unknown to Mankind; and it ſeems moſt probable, that the *Stamina* of all the *Plants* and *Animals* that have been, or ever ſhall be in the *World* have been formed *ab Origine Mundi*, by the *Almighty Creator* within the firſt of each reſpective Kind. And he who conſiders the Nature of *Viſion*, that it does not give us the true Magnitude, but the Proportion of Things, and that what ſeems to our naked Eye but a Point, may truly be made up of as many Parts as ſeem to us to be in the whole Viſible World, will not think this an Abſurd or Impoſſible thing.

But the Second thing which later Diſcoveries have made Probable is, that theſe *Animalcules* are originally *in Semine Marium & non in Fœminis*: And this I Collect from theſe Conſiderations.

1. That there are Innumerable *Animalcula in Semine Maſculo Omnium Animalium*. M. *Leewenhoeck* has made this ſo Evident by ſo many Obſervations, that I do not in the leaſt Queſtion the Truth of the thing.

2. The Obſerving of the *Rudiments* of the *Fœtus* in Eggs, which have been *Fœcundated* by the Male, and the ſeeing no ſuch thing in thoſe which are not *Fœcundated* as appears from *Malpighius* his Obſervations, makes it very Probable, that theſe *Rudiments* proceeded originally from the Male, and not from the Female.

3. The Reſemblance between the *Rudiments* of the *Fœtus in Ovo*, both before and after *Incubation* and the *Animalcule*, makes it very Probable, that they are one and the ſame. The ſame Shape and Figure which M. *Leewenhoeck* gives us of the *Animalcule*, *Malpighius* likewiſe gives us of the *Rudiments* of the *Fœtus*, both before and after *Incubation*; yea, and even the *Fœtus*'s of *Animals* do appear ſo at firſt to the Naked Eye, ſo that Dr. *Harvey* does Acknowledge that all *Animals*, even the moſt Perfect, are begotten of a Worm.

De Gen. Anim. Ex. 18.

4. This gives a Rational Account of *Many Fœtus*'s at one Birth, eſpecially that of the Counteſs of *Holland*, and how at leaſt a whole Cluſter of Eggs in a *Hen* are *fœcundated* by one *Coition* of the *Male*.

5. This gives a new Light as it were to the *firſt Prophecy* concerning the *Meſſiah*, that the *Seed of the Woman ſhall bruiſe the Head of the Serpent*: All the reſt of Mankind being thus moſt properly and truly the *Seed of the Man*.

6. The *Analogy* I have already mentioned, which we may rationally ſuppoſe between the Manner of *Propagation* of *Plants* and *Animals*, does likewiſe make this Probable. Every Herb and Tree bears its Seed after its Kind; which Seed is nothing elſe but a Little Plant of the ſame kind, which being thrown into the *Earth*, as into its *Uterus*, ſpreads forth its Roots, and receives its Nouriſhment, but has its Form within it ſelf; and we may rationally conjecture ſome ſuch *Analogy* in the *Propagation of Animals*.

The 3d particular which later Diſcoveries make Probable is, that *Animals* cannot be Formed of theſe *Animalcula* without the *Ova in Fœminis*, which are neceſſary for ſupplying of them with proper *Nutriment*; and this theſe Conſiderations ſeem to Evince. 1. It is probable that an *Animalcule* cannot come forward if it do not fall into a proper *Nidus*. This we ſee is the *Cicatricula* in *Eggs*; and tho' a Million of them ſhould fall into one Egg, none of them would come forward, but what were in the Center of the *Cicatricula*; and perhaps the *Nidus*, neceſſary for their Formation, is ſo Proportioned to their Bulk, that it can hardly contain more than one *Animalcule*; and this may be the Reaſon why there are ſo few Monſters.

This we ſee is abſolutely neceſſary *in Oviparis*, and the only diſ which ſeems to be between them and the *Vivipara* in this Matte is this, that in the latter the *Ova* are properly nothing more but the Ci *cula*, with its *Colliquamentum*, ſo that the *Fœtus* muſt ſpread forth its R into the *Uterus* to receive its Nouriſhment; but the Eggs in *Ovipara* be properly termed an *Uterus* in relation to the *Fœtus*; for they cont not only the *Cicatricula* with its *Amnion* and the *Colliquamentum*, which the immediate Nouriſhment of the *Fœtus*, but alſo the Materials wh are to be converted into that *Colliquamentum* ſo that the *Fœtus* ſpreads its *Roots* no farther than into the *White* and *Yolk* of the *Egg*, from when derives all its Nouriſhment. Now that an *Animalcule* cannot come for without ſome ſuch proper *Nidus*, M. *Leewenhoeck* will not readily De for if there were nothing needful but their being thrown into the *Ute* do not ſee why many Hundreds of them ſhould not come forward at o at leaſt whilſt ſcatter'd in ſo large a Field.

Now 2. That this *Cicatricula* is not originally *in Utero*, ſeems Evid Vid. ſ.f. Vol. III. cap IV. §. CXII & CIX. from the frequent *Conceptions* which have been found *extra Uterum*; ſu as the Child which continued 26 Years in the Woman of *Tholouſe's* Bel and the *Little Fœtus* found in the *Abdomen* of *Mad. de S. Mere*, toget with the *Teſtitle* torn and full of Clotted Blood; ſuch alſo ſeem to be t *Fœtus* in the *Abdomen* of the Woman of *Copenhagen*, mentioned in the N *velles des Lettres*, for *Sept.* 85 all the Members of which were eaſily to felt thro' the Skin of the Belly, and which ſhe had carried in her Belly 4 Years: And the 7 Years Gravidation related by Dr. *Cole*. Now gra Vid. Inf. Vol. III. cap. IV. § CXVII. ing once the neceſſity of a proper *Nidus*, for the Formation of an *Ani cule* into the *Animal* of its reſpective Kind, theſe Obſervations make it pr bable, that the *Teſtes* are the *Ovaria* appropriated for this uſe; for thoug the *Animalcles* coming thither in ſuch Caſes, may ſeem to be Extraordin and that uſually the Impregnation is *in Utero*, yet it may be Collected fr hence, that the *Cicatriculæ* or *Ova* to be *Impregnated*, are in *Teſtibus fœ mineis*; for if it were not ſo, the Accidental coming of *Animalcules* thith could not make them come forward more than in any other Part the Body, ſince they cannot be Formed and Nouriſhed without a *prop Nidus*.

But 3. It is acknowledged by all that the *Fœtus in Utero*, for ſome con ſiderable time after *Conception*, has no *Connexion* with the *Womb*; that it ſe wholly Looſe to it; and is perfectly a little round Egg with the *Fœtu* i the midſt, which ſends forth its *Umbilical Veſſels* by Degrees, and at la hold on the *Uterus*. Now from hence it ſeems Evident, that the *Cicatricu la*, which is the Fountain of the *Animalcule's* Nouriſhment, does not ſpro from the *Uterus*, but has its Origin elſewhere, and falls in thither as in a fit Soil, from whence it may draw *Nutriment* for the *Growth* of the *Fœtu* elſe it cannot be eaſily Imagined how it ſhould not have an *Immedia Connexion* with the *Uterus* from the time of *Conception*.

If you Joyn all theſe Three Conſiderations together, *viz.* that an *Animalcule* cannot *come forward* without a Proper *Nidus*, or *Cicatricula*; that there have been frequent *Fœtus*'s *extra Uterum*; and that they have no *Adheſion* to the *Uterus* for a conſiderable time after *Conception*; they ſeem to make it Evident that *Animals* cannot be Formed *ex Animalculis* without the *Ova in Fœminis*. To all theſe I ſhall ſubjoyn the Propoſal of an *Experimentum Crucis*, which may ſeem to Determine whether the *Teſtes Fœminea* be truly the *Ovaria*, *viz.* open the *Abdomen* of the *Females* of ſome Kinds, and cut out theſe *Teſticles*, and this will Determine whether they be abſolutely neceſſary for the *Formation* of *Animals*.

It is indeed Difficult to Conceive, how theſe *Eggs* ſhould be *Impregnated per Semen Maris*, both becauſe there is no *Connexion* between the *Tube* and the *Ovary* for its Tranſmiſſion; and for that Dr. *Harvey* could never Diſcover any thing of it *in Utera*. But as to the laſt, M. *Leewenhoeck* has cleared that difficulty, by the Diſcovery of Innumerable *Animalcula Seminis Maris in Cornubus Uteri*, and thoſe Living a conſiderable time after *Coition*. And as to the former, we may either ſuppoſe that there is ſuch an *Inflation* of the *Tubæ*, or *Cornua Uteri tempore Coitionis*, as makes them *Embrace* the *Ovaria*, and ſuch an *Approach* of the *Uterus* and its *Cornua*, as that it may eaſily Tranſmit the Seed into the *Ovary*: Or elſe, that the *Ova* are *Impregnated* by the *Animalcules* after they Deſcend into the *Uterus*, and not in the *Ovary*. The former ſeems Probable for this Reaſon, that at leaſt a whole Cluſter of Eggs in a Hen will be *Fecundated* by *one Tread* of the *Cock*; now this *Fecundation* ſeems to be in the *Vitellary*, and not in the *Uterus* as the Eggs paſs along from Day to Day; for it can hardly be ſuppoſed that the *Animalcules* ſhould Subſiſt ſo long, being ſcattered looſely in the *Uterus*, as to wait there, for many Days, for the *Fecundation* of the Eggs as they paſs along. The latter Conjecture has this to Strengthen it, that the *Animalcules* are found to Live a conſiderable time in the *Uterus*, and that if they ſhould *Impregnate* the *Ova* in the *Ovary* its ſelf, the *Fœtus* would encreaſe ſo faſt, that the *Ova* could not paſs through the *Tubæ Uteri*, but would either burſt the *Ovary*, or fall down into the *Abdomen* from the Orifices of the *Tuba*; and that from hence proceed thoſe Extraordinary *Conceptions in Abdomine extra Uterum*.

But, M. *Leewenhoeck* to weaken this Conſideration, about the *Conception*'s being like unto an *Ovum* in the *Womb*, propoſes a Parallel between theſe *Animalcules* and *Inſects*, and inſinuates that as the latter caſt their Skins and appear of another ſhape, ſo the other which at firſt ſeem like *Tadpoles*, may caſt their outer Skin and then be Round; and that this may be the occaſion of the round Figure of the *Conception* in the *Womb*. To this it may be replied, that according to M. *Leewenhoeck*'s own Sentiment, the *Animalcules* cannot *come forward* if they do not find the *Punctum* or proper Place for their Nouriſhment, to which it ſeems they muſt have ſome *Adheſion*. Now the *Conception* in *Viviparis* is not faſtened unto the *Womb* for many Days, nor does Adhere to any point of it; ſo that it ſeems this roundiſh Body is not the *Animalcule* thus changed after having caſt an outer Skin, but is n. 174. p. 1132.

rather the *Cicatricula*, or little Egg, into which the *Animalcule* has enterd as its *Punctum*, or Place of Nouriſhment; elſe I do not ſee why they ſhould not be *Adhering* to the *Womb* from the *firſt Conception*, or why (as I have ſaid) many Hundreds of them are not Conceived and Formed together.

By Sir J. Floyer. n. 259. p. 433. 2. I have oft Reflected on the Figure of a *Mule*, that being an *Animal* produced by the Copulation of an *Aſs* and a *Mare*, the Extremities of the Body, the Feet, Tail and Ears, and that Black Croſs on the Back reſemble that of the *Aſſes*. By this we may Obſerve, that the Female contains in her Eggs the firſt Rudiments of the Animal of her own Species and that the *Impregnation* only changes ſome of the *Extremities* into a Reſemblance of the *Male*. This ſeems to Contradict our new Diſcoveries; For if the *Male* ſupplies the *Animalculum*, the *Fœtus* muſt always be of the ſame Species as the *Male*; if the Female ſupplies it, of her Kind; whereas Monſters are obſerv'd to be a Mixture of both Species.

CXXVI. Papers *of leſs general Uſe* Omitted.

n. 77 p. 3034 Queries concerning *Vegetable Excreſcencies* and the *Inſects* bred in them; by Dr. *Liſter*.

n. 249. p. 59 2. Several *Inſects* found near *Colcheſter*; by Mr. *Dale*.

n. 8. p. 137. 3. Prodigious Swarms of *Locuſts* in *Ukrania*: Extracted from M. *de Beauplan's Deſcription of the Countries of* Poland; and M. *Thevenot's Voyages*. pt. 1.

4. Some general Inquiries concerning *Spiders*; by Dr. *Mart. Liſter*.

n. 72 p. 2171. n. 77. p. 3002 5. *Queries* concerning *Tarantula*'s; by Dr. *M. Liſter*.

n. 105. p. 96, 99. 6. Some general *Queries* concerning Land and Freſh Water Snails: And Part of a *Table* of them; with their Figures; by Dr. *M. Liſter*.

n. 222. p. 322 7. An Account of ſeveral Rare and Curious Shells to be met with in *Scotland*; by Sir *Rob. Sibbald*.

n. 100 p. 7002. 8. To Prevent the Rot of *Sheep*, by giving them *Spaniſh Salt*; Extracted from Mr. *Boyle*'s *Uſefulneſs of Experimental Philoſophy*. Tom. 2 p. 25.

n. 103. p. 50 9. Inquiries and Directions concerning *Sheep*, to preſerve them, and to improve the Race of *Sheep* for *Hardineſs*, and for the *fineſt Drapery*; by Dr. *T. Beale*.

CXXVII. *Accounts of Books*, Omitted.

n. 28. p. 535 n. 64. p. 2078 n. 76. p. 2281 Hiſtoria Generalis *Inſectorum*, *J. Swammerdami*, Pars Prima. *Ultraject*. 1669. 4to.

2. Johanna

2. Johannes Goedartius of Inſects, done into *Engliſh*, and Methodiz'd: with the Addition of Notes; by *Mart. Liſter*, Eſq; 1682. in 4*to*. n.143.p.22.

Joh. Goedartius de *Inſectis*: cum Appendice ad *Hiſtoriam Animalium Angliæ*; a *Mart. Liſter*. M. D. n.166.p.833

3. *Marc. Malpighii* Diſſertatio Epiſtolica de *Bombyce*; *Regiæ Societati* Dicata. *Lond*. in 4*to*. n.49.p.981

4. Inſtructions for the Planting of White Mulberries; the Breeding of Silk Worms; and the Ordering of *Silk* in *Paris*, and the Circumjacent Parts; by M. *Iſnard*. n.5.p.87.

5. Experienze Intorno alla *Generatione* Degl' *Inſetti*; fatte da *Franciſco Redi*, Academico della *Cruſca*. In *Firenze*. 1668. 4*to*. *The Opinion of that* Author *concerning the* Generation *of* Inſects *is here Opoſed by Dr*. M. Liſter. n.57.p.1175 n.75.p.2254

6. Ricreatione dell *Occhio* e della *Mente*, Nell' Oſſervation delle *Chiocciole*; dal P. *Filippo Buonanni &c.* in *Roma*. 1681. n.156.p.507

7. Relatione del Ritrovamento dell' *Uova* delle *Chiocciole*; di A. F.M. in una Littera al S. *Marcello Malpighi*. in *Bologna*. 1683. n.152.p.356

8. Dr. *Kormannus*, concerning the *Tinctures* of the *Excrements* of *Inſects*. n.74.p.2218

9. *Swammerdam*'s M. S. Treatiſe *de Apibus*; *'tis ſear'd to be loſt by Dr* Hotton. n.257.p.365

10. *Mart. Liſter* Hiſtoriæ Animalium *Angliæ* Tres Tractatus; Unus *de Araneis*; Alter de *Cochleis* tum *Terreſtribus*, tum *Fluviatilibus*: Tertius de *Cochleis Marinis*. Quibus adjectus eſt Quartus, de *Lapidibus* ejuſdem *Inſulæ*, ad *Cochlearum* quandam *Imaginem Figuratis*. *Lond*. 1678. n.139.p.982

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